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MYCOTAXON

*AN INTERNATIONAL JOURNAL FOR RESEARCH ON
TAXONOMY & NOMENCLATURE OF FUNGI, INCLUDING LICHENS*

Volume LXXV July-September 2000

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ALTERNARIA THEMES AND VARIATIONS (244-286)
SPECIES ON SOLANACEAE

EMORY G. SIMMONS

717 Thornwood Road, Crawfordsville, IN 47933

ABSTRACT

A continuation of a series of papers primarily on *Alternaria*, in this instance for phaeodictyosporic taxa described from hosts/substrates in the Solanaceae. Of the approximately 67 names published validly or invalidly for this group (1875 to date), 22 are retained for taxa in *Alternaria* and *Nimbya*. Of these, 13 are presented as spp. nov., comb. nov., or nom. nov., including *Alternaria subtropica* Simmons (on *Lycopersicon esculentum*), *A. beringelae* Simmons (on *Solanum melongena*), *A. tomatophila* Simmons (on *L. esculentum*), *A. subcylindrica* Simmons & R. Roberts (on *L. esculentum* var. *cerasiforme*), *A. cretica* Simmons & Vakalounakis (on *L. esculentum*), *A. polytricha* (Cooke) Simmons (on *S. melongena*), *A. capsici* Simmons (on *Capsicum annuum*), *A. cyphomandrae* Simmons (on *Cyphomandra betacea*), *A. elegans* Simmons & J. David (on *L. esculentum*), *A. nitrimali* Simmons & M. E. Palm (on *S. viarum*), *A. grandis* Simmons (on *S. tuberosum*), *A. africana* Simmons (on *S. melongena*), and *Nimbya major* (Pavgi & Singh) Simmons (on *Nicotiana plumbaginifolia*).

Keywords: *Alternaria*, *Macrosporium*, *Nimbya*, *Stemphylium*, Solanaceae, *Capsicum*, *Cyphomandra*, *Datura*, *Lycopersicon*, *Nicandra*, *Nicotiana*, *Solanum*

XXVIII. SPECIES OF ALTERNARIA ON SOLANACEAE
with disposition of some names of non-
Alternaria phaeodictyosporic hyphomycetous
taxa described from the same host family

Introduction

At least 67 names with actual or potential *Alternaria* affinity have been published for taxa of phaeodictyoconidial hyphomycetes studied on or isolated from species of Solanaceae (1875 through these present notes). This total includes not only names of purported species but also those of a miscellany of *varietates*, *formae*, *formae speciales*, and their variant recombinations.

Range of Study. All names published for these solanacicolous taxa are considered here. An opinion is given on the identity and correct name of each taxon, with particular attention paid to interpretation of type material. Names that have not been published validly also are included, with comment, but only in order to reduce some of the irrelevant literature clutter that faces any student of the genus. An attempt also is made to determine the application of all pertinent names published in the genus *Macrosporium* Fr., whether they are *Alternaria* or not, as has been done in all previous papers of this *Alt.T&V* series.

Routine/standard Culture Conditions. Descriptive treatments of taxa are supported by living isolates when possible. Routine culture conditions include 100mm diam. Y-plates, each with PCA, Hay decoction, and V-8 juice agars in the three sectors; room temperature near 20C; 8/16hr. cool-white fluorescent light/dark cycle (Simmons and Roberts 1993).

Measurement Conventions (conidiophores and conidia). Width of long elements may change measurably, and characteristically, from point of origin to tip. An arrow is used to indicate the proximal⟶distal measurement; e.g., conidiophores that widen distally may be noted as ... x 5⟶8µm. Measurements for rostrate conidia are noted in a body + beak format, e.g., 83-114 x 16-23 + 99-217 x 2µm.

Note on Septation. Conidia of all *Alternaria* taxa initially are distoseptate. Insertion of eusepta through the distoseptum matrix is a second stage in cell-wall formation. Euseptum formation may be tardy or inconspicuous, as in *A. cyphomandrae*; or the euseptum may appear as the dominant layer in the septum complex of mature conidia, as is the case in many species of *Alternaria*, both small- and large-spored.

Specimen and Isolate Source Data. Each specimen or isolate discussed in the text is cited with an EGS study number (e.g., *Alternaria solani* EGS 44-098). Details of source data are assembled in an **Appendix**, in EGS numerical order, as the best solution to recording reference information that is not essential to textual discussion.

* * * * *

Although clients of mycotaxonomy, especially phytopathologists, may wish otherwise, it nevertheless is an easy prediction that this presentation of 21 accepted species is far from being a comprehensive compendium of *Alternaria* species occurring on Solanaceae. Considering that *Helianthus annuus* L. harbors at least three distinctive *Alternaria* species (*Alt.T&V* 17-21; Simmons 1986), *Triticum aestivum* L. at least five (*Alt.T&V* 106-111; Simmons 1994b), and *Euphorbia pulcherrima* Willd. at least four (*Alt.T&V* 145-149; Simmons 1996), it is likely that the neotropical heartland of solanaceous diversity, Central and South America, will yield more examples of *Alternaria* diversity associated with many of the estimated 2000 species (Willis 1985) of Solanaceae.

The taxonomic reference/compilation literature on solanacicolous species of *Alternaria* is not extensive. Neergaard (1945) treated material under only two names (or their obligate synonyms)—*A. crassa* (Sacc.) Rands and *A. solani* Sorauer—as did Joly (1964); and M. B. Ellis (1971) handled material under the same two species names, plus *A. longipes* (Ell. & Ev.) Mason.

The emphasis of these authors on disease incitants of a few species of five host genera—*Solanum, Lycopersicon, Datura, Nicotiana,* and *Capsicum*—reflects quite well the focus of most of the literature of taxonomy and phytopathology for almost 125 years as well as the enormous commercial value of the hosts. However, it also has led to an unrealistic, unacceptably broad concept of species definition and host range for large-spored *A. solani* Sorauer—the name most commonly applied to *Alternaria* incitants of pathologies in Solanaceae.

Most of the work on solanacicolous *Alternaria* for over a century has been confined to *Alternaria longipes* on tobacco and to "*Alternaria solani*," as reported on potato, tomato, peppers, and eggplant. There is a minor amount of attention to comparing field specimen fungi and their isolates, primarily from potato and tomato (Rands 1917; Rosenbaum 1920a, 1920b; Rotem 1966), but no consideration is given in commonly referenced manuals (Neergaard 1945; Joly 1964; Ellis 1971) to the possibility that more than one morphological taxon may be included in their "*A. solani*" concepts or in the pathology pictures of the several hosts. Non-taxonomists, following these leads, routinely have adopted for their material the name originally referant to the potato disease fungus (*A. solani* Sorauer, or one of its synonyms), regardless of the host source (Rotem 1994; Weir et al. 1998). Some recently published molecular data suggest at least a two-taxon *Alternaria* involvement (Weir et al. 1998).

An Aside on Purpose and Content of *Alt.T&V* Emphasizing Species (Mis-)Identifications and Phytopathologists' Need-to-Know

My personal views on style, content, and target audience for these *Alt.T&V* essays never have been stated. By now the series has reached sufficient dimensions that a position statement may prove useful (*Alt.T&V* 1-286, 1981-2000). This present set of notes on *Alternaria* from Solanaceae is a convenient place to present such views and, in particular, to weigh them against a published opinion that the *Alt.T&V* presentations do not provide phytopathologists with information needed for routine identification (Rotem 1994, discussed below).

It has not been surprising to realize over the years that my approach is neither philosophically unique nor uniquely modern. Latinist William T. Stearn introduced the first edition of his most admirable *Botanical Latin* (1966) with an "*Apologia pro Libro meo*," the first paragraph of which quoted the intentions of naturalist/scholar John Ray (1691) in publishing his own writings. Ray's 17th century intentions, condensed, parallel mine: presentation of new material "untoucht" by others, in a manner leading to understanding by the enquiring mind, and assembling at the same time pertinent information that lies scattered in other publications.

My style is intentionally discursive and didactic, not telegraphic—presenting more information than will be used, but never emptying the files and literature resources. Contents comprise pertinent historical background, without which good guidance may be lost and errors compounded; comparison of culture vs. field characteristics (when available); emphasis on patterns of sporulation in culture; and consideration of the juvenile conidium through to its maximum development under defined growth conditions. My target audience is not limited to hyphomycete specialists. Instead, the target is largely phytopathologists who, at one and the same time, are the major contributors of study material, queries and operational support—and, if I am successful, the beneficiaries of whatever identification and classification clues they may glean.

Alternaria, a very large genus in numbers of taxa, is difficult in every sense, both for the specialist and for user colleagues. It has been my observation over the years that most approaches to classification of *Alternaria* species have been reductionist rather than analytic. Under the pressure for producing "identifications," the practice in most laboratories has been to oversimplify characterizations in this large, morphologically complex genus.

All of us—presenter and user—must cope with the fact that any individual mature conidium has developed through a progression from a one-cell juvenile to a multicellular adult; that conidium-chain production assumes several different three-dimensional patterns; and that the population of conidia at any moment—in nature or in culture—reflects the various environmental influences active over a very short period of time. Rarely is it possible to equate a study preparation precisely with a type specimen or its description, or, in the case of field specimens, to judge the degree of development of the conidium sample.

A strong popular tendency has been to ignore seemingly small though consistent developmental differences, and to identify a variety of morphologically similar taxa from lesions on somewhat related hosts simply as a single species—relying more on host symptoms than on an evaluation of the fungi involved. Such has been the case with identifications among several large-spored species of an "*A. solani*" group of taxa—with a result matching an observation of writer/critic H. L. Mencken (1920): "...there is always a well-known solution to every [complex] problem—neat, plausible, and wrong."

It is relevant in this introductory context to mention the published views of J. Rotem on *Alternaria* taxonomy, since his guidance to phytopathologist identifiers differs markedly from my own. Much of Rotem's published work is on *Alternaria* early blight of potato and tomato (summarized abundantly in a single volume in 1994, and publicized extensively by the American Phytopathology Society, which published the volume). In an early chapter on "*Species, Formae Speciales, and Strains*" of *Alternaria*, Rotem opens with a disclaimer—that his chapter "is not a taxonomic treatise on the genus *Alternaria*"; but "is written for plant pathologists interested in classification and identification of the major *Alternaria* species..." The first part of the quotation proves correct; the second part encompasses misguidance.

Rotem guides his audience to Neergaard ("pathologists may be confused by the variability in the described isolates"; Rotem p. 14); and to Ellis (whose "descriptions...appear in a concise form."; Rotem p. 14); then adds that "the most difficult identification of species appears in some articles of Simmons (1965, 1967, 1981, 1982, 1990), who analyzed minute differences between various species without providing the phytopathologically oriented reader with the main facts needed in a routine identification." (See *Alt.T&V* 257-266 for discussion of how poorly routine identifications of *Alternaria solani* have been handled in the past.)

"Difficult identifications" in *Alt.T&V*—perhaps, but no more so than the rigors of other disciplines that the modern pathologist must master, which still includes, I trust, some exposure to morphology-based mycology. My opinions and those of Rotem diverge markedly on the question of whether or not species characterization in these *Alt.T&V* papers provides information—"the main facts"—needed for identification of species presented in them. If "routine identification" of *Alternaria* by pathologists requires ancillary information on disease symptoms, they will not find them in the primarily morphotaxonomic focus of the *Alt.T&V* notes—or to any unambiguous extent in Neergaard and Ellis, or in the beautifully produced APS disease compendium volumes, or in Rotem—since such information on disease lesions of Solanaceae can be considered only conjectural, or at most useful in narrowing possibilties, but not species diagnostic in *Alternaria* classification.

For the guidance of both taxonomists and pathologists of the mycological persuasion—especially to recent, current and oncoming generations attempting to relate their molecular and genetic data to the pathology of morphology-defined *Alternaria* species—I offer some comments on what is useful and can be validated in major identification literature. My conclusion, reached below in detailed comparisons of some similar *Alternaria* species, is a point of departure—namely, that the phytopathologists' "routine identification" requirement of the literature has failed them in the case of the much-belabored, so-called "*Alternaria solani*," to which so much phytopathology research, including Rotem's, has been devoted.

Briefly, in the Solanaceae, the routine identification of *Alternaria* pathogens from major hosts—potato, tomato, eggplant—usually has been in error for tomato and eggplant. In particular, *Alternaria solani* Sorauer, which causes enormous damage as the incitant of early blight of potato, is a distinctly different species than the one that causes the similar "early blight" disease of tomato and than another one that infects eggplant.

"Minute differences" in the morphology of *Alternaria* sporulation, species to species, often become major, irreducible character differences when stable isolates of the "*A. solani*" group of similar species are compared under controlled conditions of culture on media that favor sporulation instead of mycelial mass. Neither Neergaard nor Ellis, nor apparently Rotem, relied on culture techniques that would allow them to make critical comparisons in the "*A. solani*" group. Their published guidance on "*A. solani*" yields only a species-group identification. If the target fungus, regardless of solanaceous host species, has large conidia with a long narrow beak, it has been called *A. solani*—incorrectly in the case of tomato—and the minute differences ignored for practical and sometimes research purposes. This may be close enough for anyone who is going to recommend covering a crop with a fungicide; it is not sufficient basis for discussing classification of *Alternaria* taxa.

Fortunately for more critical needs, typical *A. solani* isolates from potato can be distinguished from the numerous isolates I have examined from leaf lesions of tomato. Differentiation between the two requires no more than a glance under 40X magnification, or less, if they are grown under recommended conditions on PCA and V-8 juice agars. Controlled conditions of growth and examination accentuate the "minute differences."

My guidance, therefore, to "plant pathologists interested in classification and identification of the major *Alternaria* species"—in this instance especially of large-spored *Alternaria* species on *Solanum* and *Lycopersicon*—is as follows. If there is a practical or a research need-to-know what taxa constitute the "*A. solani*" group of pathogens as they occur on various solanaceous hosts, the answer is not in Neergaard or in Ellis or elsewhere to my knowledge. For this group, comparisons and observable differences are detailed below. Identification of the individual taxa of the group is not as difficult as might be thought; and the not-so-minute differences that define them provide us with "the main facts needed in a routine identification," despite Rotem's opinion that they are not helpful to the phytopathologically oriented reader.

My correspondence with phytopathologists worldwide, on a great variety of taxonomic matters alternarioid, supports a view somewhat different than Rotem's on the usefulness of these *Alt.T&V* presentations by pathologists. Additionally, to an appreciable extent and to my gratification but not surprise, conclusions reached in these notes—on both small-spored and large-spored taxa—are beginning to find parallels with results in *Alternaria*-related molecular and metabolite studies (Andersen and Thrane 1996; Jasalavich et al. 1995; Peever et al. 1999; Roberts et al. 2000; Weir et al. 1998).

I urge any individual who has specific *Alternaria* identification requirements to take a few steps beyond the 25-50-year-old *Alternaria* treatments of Neergaard (1945) and Ellis (1971, 1976). And having known both of these excellent mycologists personally, and admiring their work immoderately, I guarantee that both would urge the same steps of progress in *Alternaria* taxonomy and pathology. Without good morpho-taxonomy, there is no(-)good phytopathology

* * * * *

Discussions of taxa are presented in approximately chronological order of publication of the basionym of accepted/correct species names. Synonyms, both obligate and taxonomic, are simply listed under an accepted name; they are discussed individually following treatment of the accepted species name.

Following the discussion of species in the main text there is a list of names that have appeared in publication with some relationship to the material under discussion here, but that are *nomina nuda*, were introduced in error, or are misattributions of some sort. The list is appended only to obviate the waste of time of anyone encountering them and searching the literature to learn what they mean. They have no status in *Alternaria* nomenclature under ISBN rules (Greuter et al. 1994).

244. Earliest description of early blight of potato? An unaccepted name.

244. **Alternaria brassicae** (Berk.) Sacc. var. **solani** (Schenk) Preissecker (1916), Fachl. Mitteil. österr. Tabakregie 16: 14.

≡ *Sporidesmium exitiosum* Kühn var. *solani* Schenk (1875), Centralbl. für Agrikulturchemie (Biedermann) 8: 282. Type: unknown; presumed lost in WW II.

Schenk's "var. *solani*" of 1875 cannot be identified with certainty. I have found no clue to the existence of a type specimen; and there is no illustration in his paper for guidance. For taxonomic purposes the variety is essentially a nomen nudum. However, Schenk was a keen observer and, judging from the text of his paper, may have published the first description of "early blight of potato," along with a few microscopic details of the incitant fungus (now universally ascribed to *A. solani* Sorauer; see *Alt.T&V* 258 below).

Schenk's priority—historical and observational, rather than nomenclatural—merits admiration.

Schenk observed the summertime progress of a brown-lesion disease of potato stems and leaves and described the development of a dark-spored fungus on the spots in remarkable detail: a rounded conidium initial that quickly became long-ovoid, with the broader end basal (an *Alternaria* character missed by many describers, even into the 20th century), at first building transverse septa, then inserting sufficient numbers of longitudinal septa that the mature conidia contained a large number of cells. He watched fallen conidia germinate within 2-3 hours, with germ tubes from as many as 6-7 cells. This was an admirable piece of observation which lacked only conidium measurements or illustrations that would give firm clues to a species determination.

However, Schenk was familiar with the very influential descriptions and illustrations of Kühn (1855, 1856a, 1856b) for the earliest two well-defined large-spored species of *Alternaria*—*Sporidesmium exitiosum* Kühn and *S. exitiosum* var. *dauci* Kühn—which we now know respectively as *A. brassicae* (Berk.) Sacc. (1880) and *A. dauci* (Kühn) Groves & Skolko (1944). Schenk, comparing his potato pathogen with Kühn's taxa, opted reasonably for "*S. exitiosum* var. *solani* Schenk, var. nov." It seems likely that this is the earliest published description of "*A. solani*," but proof remains unlikely and only of historical or, possibly, synonymic interest.

Preissecker (1916) brought Schenk's "var. *solani*" into *Alternaria* as *A. brassicae* var. *solani*, as indicated above; and in a spate of name manipulation—instead, it appears, of familiarity with *A. brassicae*—listed well-known and widely accepted species-rank *Macrosporium solani* Ellis & Martin (1882) and *A. solani* Sorauer (1896) as synonyms. No other student of the genus has recognized or maintained Preissecker's taxonomic opinion for these two morphologically and biologically disparate species, viz., *A. brassicae* mostly on Cruciferae and *A. solani* on *Solanum*. *A. brassicae* var. *solani* (Schenk) Preissecker is not an accepted name for any currently recognized taxon of *Alternaria*.

245–252 Alternaria crassa and its synonyms

245. **Alternaria crassa** (Sacc.) Rands (1917), Phytopathology 7: 337. Fig. 174-175

≡ *Cercospora crassa* Saccardo (1877), Michelia 1: 88. Lectotype (designated here) [PAD]: "*Cercospora* *crassa, Datura Stram., S.[elva] '76. 10"*; (EGS 11-177). See *Alt.T&V* 246.

= *Macrosporium solani* Cooke (1883), Grevillea 12: 32. See *Alt.T&V* 247.

= *Cercospora daturae* Peck (1884), 35th Ann. Rept. N.Y. St. Mus. Nat. Hist. (1881), p. 140. See *Alt.T&V* 248.

= *Macrosporium cookei* Saccardo (1886), Syll. Fung. 4: 530; nom. nov., *M. solani* Cooke (1883) non *M. solani* Ellis & Martin (1882). See *Alt.T&V* 249.

= *Macrosporium daturae* Fautrey (1894), in Lambotte and Fautrey, Rev. Mycol. 16: 76. See *Alt.T&V* 250.

= *Alternaria daturae* (Fautrey) Bubák & Ranojevič (1911) in Kabát and Bubák, Fungi imperfecti exsicc. no. 694. See *Alt.T&V* 251.

= *Alternaria cookei* (Sacc.) Bremer et al. (1948), Rev. Fac. Sci. Istanbul, ser. B., 13: 42. See *Alt.T&V* 252.

The work of Rands—distinguishing *Alternaria crassa* and its pathogenicity to species of *Datura* from *A. solani* causing early blight of *Solanum tuberosum*—is a model of early 20th Century myco/phytopathological study. He differentiated conidia of the two species morphologically, and showed convincingly in experimental inoculations that *A. crassa* does not infect potato or tomato and, conversely, that *A. solani* from potato does not infect several species of *Datura* available to him as test plants. (A collection of *Datura* plantings at the University of Wisconsin was available because of the then current interest in them as sources of atropin.)

The synonymy suggested by Rands (1917), augmented with *M. cookei* by Neergaard (1945) and *A. cookei* by Joly (1964), remains essentially as listed above, although all three based their opinions on literature rather than on type or authentic specimens. My concurrence with this synonymy is based on type material as well as on numerous 20th Century collections and isolates, which are discussed below.

Rands linked the dimensions of his field and cultured conidia with those of Saccardo's *Cercospora crassa*. His clues were the common host, *Datura*, and Saccardo's suggestion that the species appeared to be transitional to *Alternaria*. Conidia of Saccardo's *C. crassa* were described as fairly long 100-150 x 15-18μm; Rand, however, interpreted the Saccardo measurements to be of immature conidia and entered his own as 128-448 x 16-40μm (av. 261 x 23μm). Rand's maximum dimension presumably includes those of conidia produced in culture, as his final short description of *A. crassa* includes comment on colonies produced on potato agar. The longest conidia I have seen in many field collections fall in a length range of ca. 160-220μm. Conidia become very much longer in culture.

The few conidia examined from the type are, as Saccardo wrote, oblong and gradually extend upward into a very long filiform beak ca. 2μm wide. No beak that I have seen in the Saccardo specimen remains intact (Fig. 174), although a fragment of a narrow extension is present on each conidium. The spore bodies themselves are essentially the same size as those of many immature conidia of other later collections examined, including my own (e.g., EGS 44-071).

Saccardo recorded conidia as being 7-9 septate, sometimes with a single false ("*spurio*") longitudinal septum. The character of spurious longitudinal septa is correct if it can be interpreted as "indistinct," for some conidia of the type have 3-5 longisepta, i.e., one barely discernible in each of 3-5 transverse segments. The character is remarkable only in that it is found in similar type material of names introduced by Cooke, Peck, and Fautrey (see synonym treatments below) as well as in young conidia of freshly collected material used to establish isolates discussed here (EGS 44-071).

Field Specimen Source of Isolates (*A. crassa*)

Largest conidia on the field specimen of leaf lesions of *Datura stramonium* L. that yielded representative isolate EGS 44-071 were ca. 165 x 21μm (body 80μm long, beak 85μm), with 10 transverse septa and 1-2 longisepta in 4 transverse segments; the narrow beak itself showed 3 distinct, well-spaced cross septa. It proved possible to initiate several 1-conidium isolates from the abundant sporulation produced by field lesions held overnight in a moist chamber.

Descriptions from Cultures (*A. crassa*)

The 7-day V-8 colony of *A. crassa* sporulates best near the periphery of the colony, where primary conidiophores arise directly from an open network of radiating surface hyphae. Sporulation is meager on the young colony, which gradually develops a grey cottony overlay of long, intertwined hyphae; this aerial layer bears scattered conidia which, however, tend to be much smaller that the large, long-beaked spores considered to be diagnostic for the species in culture.

Primary conidiophores arising directly from the agar surface may be very short (ca. 20 x 8μm) or any intermediate

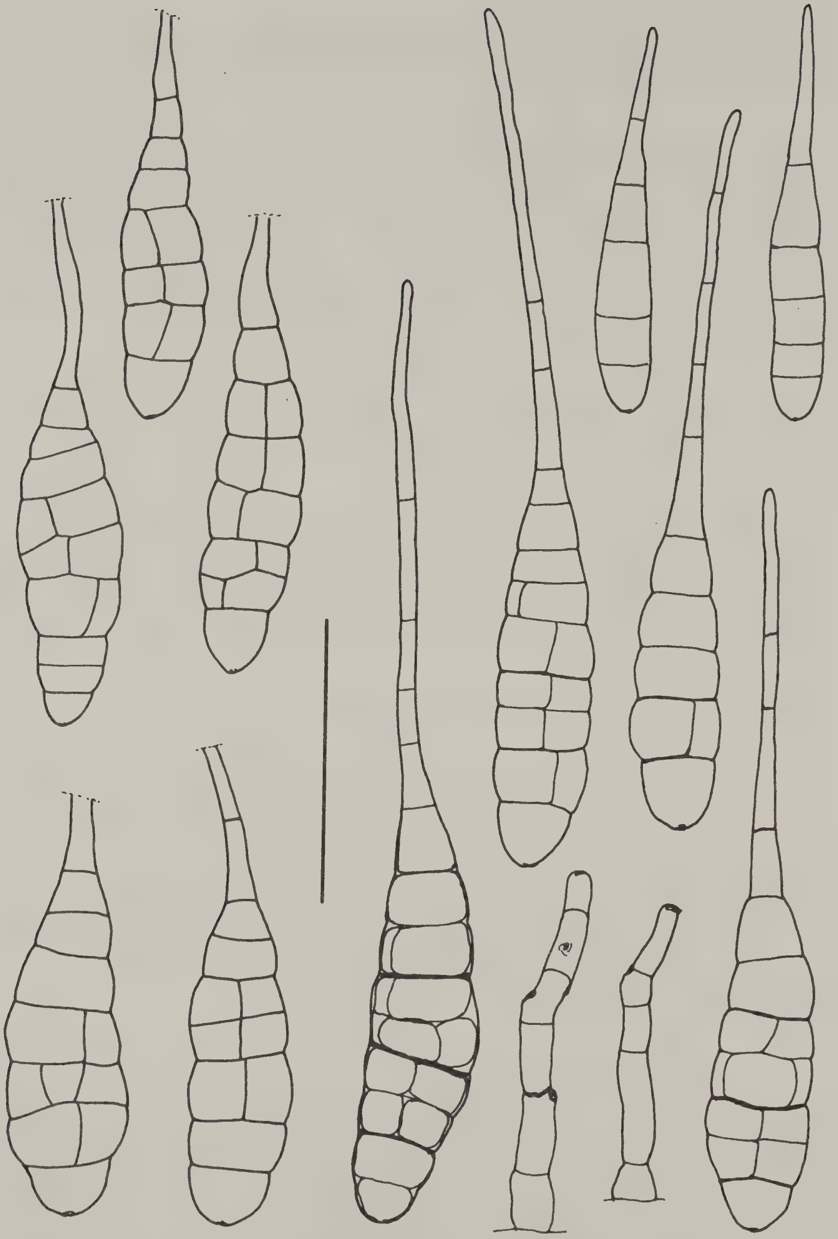

Fig. 174. *Alternaria crassa*: left of bar, conidia ex holotype of *Cercospora crassa* Sacc. (**PAD**); right of bar, fresh field conidia in EGS 44-071. Bar = 50μm.

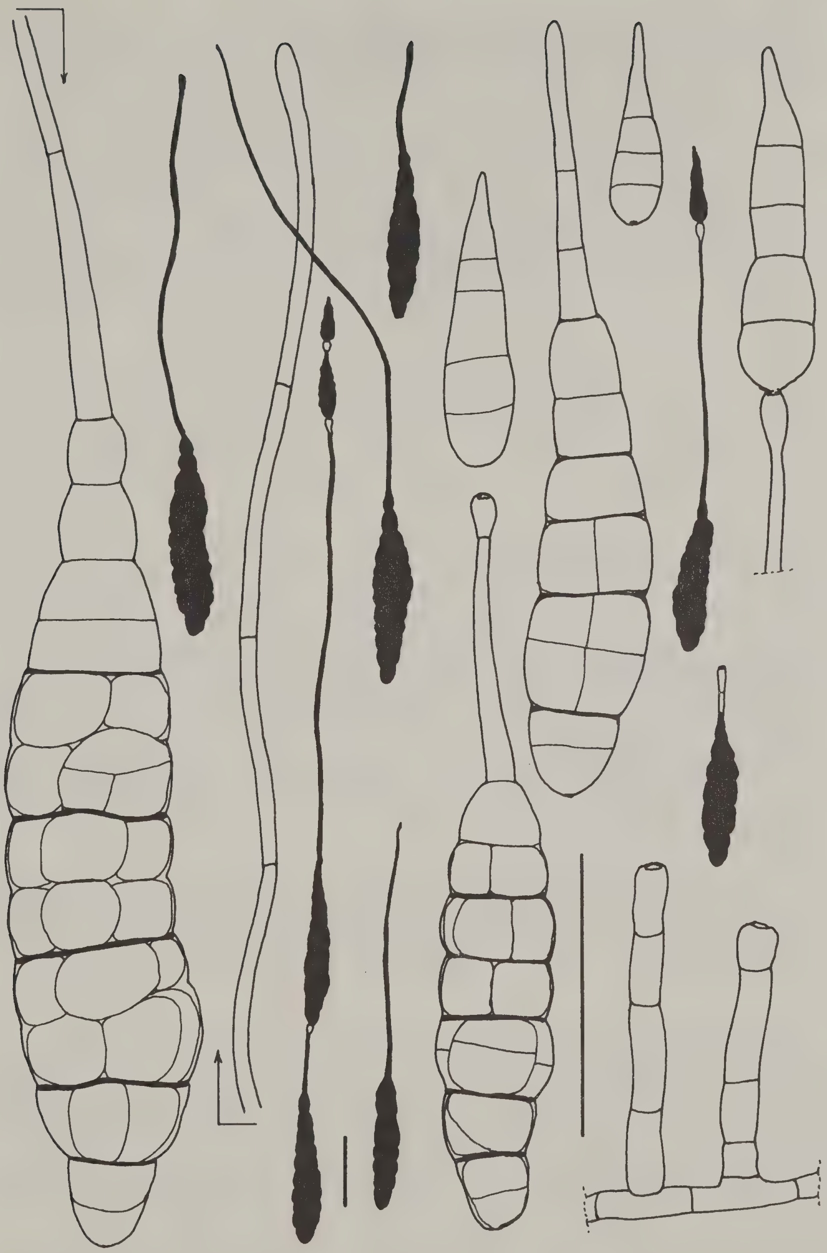

Fig. 175. *Alternaria crassa*: conidia and conidiophores from EGS 44-071 on V-8. Bars = 50μm.

length up to ca. 350μm. They are solitary and only infrequently branched; the terminal conidium may remain single or generate a short chain of one or two additional spores.

A high percentage of conidia in the surface sporulation on V-8 have relatively sturdy, extremely long beaks. Frequently the tip of such a beak becomes conidiogenous and produces a second conidium, which may remain quite small or may become equally as large and long-beaked as the initiating spore. It is also common for a large erostrate conidium to produce a strong secondary conidiophore and a short chain of 1-2 additional conidia. Conidia with branching of the narrow beak are present but rare under stated conditions.

Conidium bodies of *A. crassa* are long-ovoid or ellipsoid throughout their development. The long beak begins development in juvenile conidia and at maturity tapers gradually from its wide conidial base to a narrow tip.

Upper range dimensions of *A. crassa* conidia are 122-135 x 19-26μm, plus beaks up to 320-460 x 6-8⟶3μm; the conidium body has up to 12-16 transverse septa and 1-2 longisepta in 2-7 of the transverse segments. The long beak itself has up to ca. 17 cross septa. Internal cell delimitation is conspicuously distoseptate, and it remains so throughout development of the conidium. Only about half of the visible transverse septa actually are eusepta, i.e., attached at their circumference to the outer wall and causing constriction of the growing spore wall wherever they are formed. The remaining cross septa arise within cells that are surrounded by the distoseptum matrix.

Sporulation in parallel PCA cultures is only moderate under standard conditions. Sporulation on Hay is excellent, without or with mechanical disturbance of the vegetative hyphae.

Alternaria crassa probably occurs wherever weedy *D. stramonium* grows. Quantities of herbarium specimens from North America represent the relationship; I have never failed to find *A. crassa* in each U.S.A. Midwest stand of Jimson weed I have examined over the years. In 1997, plants of *Nicandra physalodes* (L.) Gaertner growing near infected Jimson weed had small leaf lesions that readily yielded fresh conidia and isolates indistinguishable from *A. crassa* (EGS 46-014).

246. **Cercospora crassa** Saccardo (1877), Michelia 1: 88. Lectotype (designated here) [**PAD**]: "*Cercospora crassa, Datura Stram., S.[elva] '76. 10*"; (EGS 11-177).
Fig. 174

The Saccardo herbarium at Padova has two specimens that fit his type description of "*Hab*. in foliis languidis Daturae Stramonii *a Selva*, aut 1873-76." One specimen, chosen as lectotype, bears a date "'76. 10"; the other may be the earlier 1873 specimen, but what appears to have been a date notation now is illegible.

As indicated above, the few conidia seen in the type specimen can be linked to modern collections of *A. crassa* only by comparing Saccardo's material with incompletely developed conidia in other field specimens.

247. **Macrosporium solani** Cooke (1883), Grevillea 12: 32. Lectotype (designated here) [**BPI** 0445481]: *"On leaves of Datura stramonium...S.Carolina (Rav., 3344...)"*; (EGS 47-088).

Cooke specified syntypes "Rav., 3344, 3343"—Ravenel 3344 on leaves of *Datura stramonium* and 3343 on [leaves of] tomato. Syntype portions of the Ravenel specimens are held in several herbaria; a note enclosed in the **FH** packet of Ravenel 3344 reads "55 specimens 3344...Oct. 81 Aiken, S.C. HWR." Cooke gave no differential comments for the two hosts, nor did Saccardo (1886) when he created a new name *M. cookei* Sacc. for *M. solani* Cooke because it was a later homonymn of *M. solani* Ellis & Martin (1882). (See "An Aside on Lectotypes from Divided Collections" in a discussion of "*Alternaria* in Tomato Fruit Lesions" preceding *Alt.T&V* 254.)

The name was not brought into *Alternaria* until Bremer et al. (1948) associated "*A. cookei* (Sacc.) n. comb." specifically with *Datura*. An appropriate lectotypification has been made here on the basis of the best portion of Ravenel 3344 I have seen, **BPI** 0445481. Others examined, both of the same taxon, are at **FH** (EGS 08-008) and **NY** (EGS 06-010).

Cooke gave conidium measurements of the *Datura* leafspot fungus as 60-70 x 10µm plus a long stipe (= apical beak). Spore bodies I have seen in the lectotype commonly reach a size of 50-70 x 12-17µm, with a narrow beak adding as much as 110-120µm to the total length. Bremer et al. missed Cooke's spore-plus-beak character in their discussion leading to *A. cookei* (Sacc.) comb. nov.; see *Alt.T&V* 252.

248. **Cercospora daturae** Peck (1884), 35th Ann. Rept. N.Y. St. Mus. Nat. Hist. (1881), p. 140. Holotype [**NYS**]: "*Cercospora daturae Pk., Cold Spring, C. H. Peck, Coll. N. Y. State*"; (EGS 08-098).

Peck's specimen is accompanied by drawings of a few conidia that are the same as others seen on reexamination of his specimen, but that must be considered young within the population that is actually present. Peck described and drew conidia as 51-76 x 12.7µm and with 4-6 transepta. A few conidia 90-115µm long have been found, as have longitudinal septa in 1-4 transverse segments of nearly all but young conidia like those that Peck drew and measured. Both Peck and Saccardo missed or were dubious about the longitudinal septa present in conidia of this taxon. *Cercospora daturae* Peck is identifiable as *A. crassa* (Sacc.) Rands.

249. **Macrosporium cookei** Saccardo (1886), Syll. Fung. 4: 530; nom. nov., *M. solani* Cooke (1883) non *M. solani* Ellis & Martin (1882).

When Saccardo published *M. cookei* as a new name for the later homonym *M. solani* Cooke, he simply latinized Cooke's description without differential attention to *Datura* and *Lycopersicon* as Cooke's syntype hosts. The name *M. cookei* then came into use, at least through 1943 by some authors and in widely available exsiccati, for leafspot *Alternaria* not only on *Datura* (Oudemanns 1903, Săvulescu 1930, Unamuno 1943) but also on *Solanum tuberosum* (Sydow 1897, Spegazzini 1912) and even *Capsicum* (Young 1926).

M. C. Cooke himself (1906) commented on *M. cookei* on potato in the U.K. and on tomato in the U.S.A., and added an observation that the leafspot disease of tomato was "not yet recorded as occurring in Europe." Actually, Fautrey had distributed a collection of a relatively large-spored *Alternaria* on leaves of tomato ("*Solanum Lycopersicon*") in 1897 (in Roumeguère, Fungi sel. exs. 7237; **NY**, EGS 06-017). The Fautrey specimen I have seen at **NY** now is no better than many of Ravenel's and Cooke's for this group, and therefore can neither be identified with each other nor definitely distinguished from each other on the basis of remaining material. The name used by Fautrey on F. sel. exs. 7237, "*M. solani* f. *lycopersici*" is a nomen nudum.

250. **Macrosporium daturae** Fautrey (1894), in Lambotte and Fautrey, Rev. Mycol. 16: 76. Lectotype (designated here) [**PC**]: C. Roumeguère. Fungi selecti exsiccati 6561. "*Sur feuilles de Datura Stramonium..., oct. 1893. F. Fautrey*"; (EGS 47-120).

Fautrey's collection of this taxon was distributed in several parts by Roumeguère. Leaf spots of examples studied

(**NY**, EGS 03-037; **UPS**, EGS 11-075; **PC**, EGS 47-120) are almost barren of conidia; those found are young. In the **PC** example, two fairly well-developed conidia were found, one 130µm long and very similar in shape, size, and septation to those described from *Datura* by Cooke and by Peck. Fautrey described conidia as 150-180-190 x 18-20µm, with 7-9 transepta and an occasional longiseptum; the long narrow beak itself accounted for as much as 100µm of the total length. The material is very poor, but certainly it can be accommodated within *A. crassa*.

251. **Alternaria daturae** (Fautrey) Bubák & Ranojevič (1911) in Kabát and Bubák, Fungi imperfecti exsicc. no. 694.

Aside from being a good field specimen of *A. crassa* conidia on *Datura stramonium* from Serbia (**WIS**, EGS 01-117), this printed exsiccatus label serves primarily to add another name to the synonymy of *A. crassa*. Both basionym, *Macrosporium daturae* Fautrey, and place of publication were cited.

252. **Alternaria cookei** (Sacc.) Bremer et al. (1948), Rev. Fac. Sci. Istanbul, ser. B, 13: 42.

Bremer and colleagues wrote that their material on *Datura metel* L. with conidia 30-80 x 13-19µm could not be the same species as *A. crassa* (Sacc.) Rands, with its conidia 100-150µm long (Saccardo 1877) or 128-448µm (Rands 1917, using cultures). Bremer et al. opted for *M. solani* Cooke, i.e., *M. cookei* Sacc., described with conidia only 60-70 x 10µm (Cooke 1883); they proposed to recognize two distinct species on *Datura*. However, they failed to take into account that the conidia were described by Cooke as "longe stipitatis," i.e., long beaked.

The lectotype of *M. cookei* Sacc. (≡ *M. solani* Cooke) has excellent conidia as long as 180µm (body plus beak) (**BPI**, EGS 47-088). Regardless of the identity of the Bremer specimen, the proposed "*Alternaria cookei* (Sacc.) n. comb." simply adds another name to the synonymy of *A. crassa*.

253. Macrosporium lycopersici = Alternaria?

253. **Macrosporium lycopersici** Plowright (1881), Gardeners' Chronicle, n.s., 16(II): 621. Lectotype (designated here): Plowright's illustration, l.c., p. 621, fig. 122.

No specimen has been found that can serve as type for this name. Plowright's illustration of individual conidia probably represents an *Alternaria*, although the accompanying habit drawing shows spores attached by their narrow end to conidiophores (a common faulty interpretation of the period, if these are indeed *Alternaria* conidia).

The fungus is one of several (including "*Sporocybe, Cladosporium, Phoma*") that Plowright recorded on jet-black lesions of ripening tomato fruits. Pyriform [obclavate?] conidia were said to be 20-70 x 10-20μm, with 3-6 transverse septa and 1(-2) longitudinal septa in most of the transverse divisions; chain formation was not mentioned or illustrated. In the absence of Plowright's specimen, the taxon cannot be recognized today as unique among the miscellany of *Alternaria* species with small to medium-sized conidia.

Plowright suggested that "This is probably the species of *Macrosporium* found, and I believe published, by Ravenel, from the Southern States of America, under the name of *M. tomati* [sic]"—an interesting observation, in that the name *Macrosporium tomato* Cooke was not published until 1882, in Ravenel and Cooke's *Fungi Americani exsiccati* no. 603, and then only as a nomen nudum. Presumably Plowright had pre-publication information from Cooke, who named the fungi used in *F. Amer. exsicc.* and organized and distributed the assembled exsiccata volumes from London.

Plowright's *M. lycopersici* is not identifiable more closely than as "*Alternaria*?" If it is an *Alternaria*, conidium shape, size, and septation are too unremarkable to be distinctive among descriptions of similar field specimens. Certainly its conidia do not resemble those of *Macrosporium tomato* Cooke (1883), which typically are 100-120 x 20-22μm and narrow apically into a distinct filiform beak about equal in length to the spore body (see *Alt.T&V* 255).

254-256. Alternaria in Tomato Fruit Lesions

Ripening fruits of tomato are excellent substrates for the growth of many *Alternaria* species. The slightest puncture or abrasion affords entry. The moist pulp is almost as good a substrate for mycelial growth as is V-8 juice agar, although sporulation on a well-developed lesion may be either abundant, scant, or absent.

Small-spored, chain-forming *Alternaria* taxa of great morphologic diversity are able to thrive in this environment. Sporulation patterns of isolates range across all degrees of complexity described in the genus (see Simmons and Roberts 1993). It seems likely that most tomato-fruit inhabitants of this sort are simply opportunistic, and represent whatever species inoculum is present in a given locale.

Only a few *Alternaria* species known primarily from tomato fruit lesions are distinguishable from the general run of small-spored taxa. Three are discussed below: *A. rugosa* McAlpine (*Alt.T&V* 254), *A. tomato* (Cooke) Jones (*Alt.T&V* 255), and *A. subtropica* Simmons, sp. nov. (*Alt.T&V* 256).

A. rugosa is known to me only from its type specimen (EGS 40-161) and published description. As this is the oldest name for an *Alternaria* associated with a common blackmold of tomato fruit, an attempt will be made to retain it for one of the numerous sporulation types known from this habitat.

The earliest known specimens of *A. tomato* and *A. subtropica* are H. W. Ravenel collections. Both have misleading provenance of the sort that drives taxonomists to madness and/or drink. In the period 1878-1882, M. C. Cooke in England organized and sold collections of fungi supplied to him by Ravenel from several localities of the southern U.S.A., especially Ravenel's home state South Carolina. These were distributed under the title "*H. W. Ravenel, Fungi Americani, M. C. Cooke, Editor, Centr. Londini*" (this information, and some below, is from Stevenson 1971). Ravenel assembled specimens sufficient for about 30 sets of these exsiccati; Cooke made the fungus determinations and published on new species, often citing Ravenel's collection numbers. What appear to be extra, undistributed portions of the numbered specimens are held at **K**, with a stamped "*Herb. Mycol. M. C. Cooke*," and elsewhere at least at **NY** in the "*[J. B.] Ellis Coll.*"

In the case in point (i.e., the provenance of type collections of *A. tomato* and *A. subtropica*), the substrate material gathered for *Macrosporium tomato* Cooke—excised fruit lesions—was established in Cooke (1883) as "*Rav. 3099*." Cooke material at **K** bearing Ravenel's "3099" (EGS 11-027) has a distinctive *Alternaria* taxon on at least one of the nine segments present; it is designated below as lectotype of *A. (Macrosporium) tomato*. Contrary to what might be assumed, however, there is not a shred of evidence that the undistributed remainder material at **K**—rather than one of the 30 distributed exsiccatus preparations—actually is what Cooke examined. Nevertheless, the fungus present at **K** is acceptable within the terms of the type description; there is no reason to question its status as type of *A. tomato*.

The envelope containing Ravenel's "3099" at **NY** contains six excised sporulating lesions of tomato fruit (EGS 48-032// 48-037). The original envelope is labeled in Ravenel's script and has the same collection information as the material at **K**, with one discrepancy: at **K** the manuscript collection date is given as "Sept. 1880"; at **NY** "Oct. 1880." Additionally, the fruit lesions at **K** are a restricted few millimeters in diameter, whereas those at **NY** range through diameters of 5, 7 and 10mm with well-defined borders, plus a single large, somewhat diffuse spot 20 x 25mm.

There are three morphologically different species of *Alternaria* on segments of the two specimens. The fungus typified at **K** is *A. tomato* (Cooke) Jones, with relatively slender, thin-walled, slender-beaked conidia associated with a tomato fruit disorder known as "nailhead spot." Some lesions of the **NY** portion of Ravenel's 3099 assemblage (EGS 48-034, 48-036) bear conidia of *A. tomato*, as typified at **K**; others bear a fungus with larger strong-walled conidia, *A. subtropica* (EGS 48-032, 48-035, 48-037); and a single 20-25mm lesion has dense black, matted growth of a small-spored, short-beaked, chain-forming *Alternaria* that cannot be identified specifically at present (EGS 48-033).

The fungus at **NY** with rather large, strong-walled conidia, *A. subtropica*, is one found also on at least three **BPI** specimens of USDA intercepts of tomato fruit from Mexico (detailed in *Alt.T&V* 256 as *A. subtropica*). It also is present in at least one segment of Ravenel's no. 3099 issued in *F. Amer. Exs. 603* (**PH**; EGS 01-042).

And to belabor the point, another unit of Ravenel's *F. Amer. Exs. 603* (**BPI** 446329; EGS 47-048) bears a small-spored chain-forming *Alternaria* with no resemblance to either *A. tomato* or *A. subtropica*. The lesions in this instance are larger than those of distinctive "nailhead spot"; the fungus present is somewhat similar to the small-spored taxon in the **NY** material discussed above.

It is apparent that Ravenel, in assembling the 30-40 portions necessary for the sets of *Fungi Americani* exsiccati, spread the effort not only over two months but also over at least three different tomato-fruit pathologies and their fungi. Ravenel collected miscellaneous fruit lesions; Cooke described the fungus now known as *A. tomato* on the basis of one of them. And then proceeded to confuse the issue by publishing an illustration in his *Fungoid Pests of Cultivated Plants* (1906, fig. 121) that is at odds with his description of 1883. The 1906 illustration is of a ripe tomato fruit with a relatively large, black, irregular lesion unlike the distinctive restricted nailhead of his Sept. 1880 herbarium material; the spores in Cooke's illustration could be any one of several *Alternaria* taxa that can develop in such lesions but certainly not the fungus present in the Ravenel 3099 *A. tomato* lectotype portion at **K**.

* * * * *

An Aside on Lectotypes from Divided Collections

Typification hazards are inherent in exchanges such as those of Ravenel and Cooke, mentioned above. They merit comment, since ignoring the history of the Ravenel/Cooke relationship invites not only misinterpretation of specimen portions that are conserved in several herbaria but also misunderstanding of the degree of precision that can be attributed to M. C. Cooke's "types."

Formal distribution of multiple specimens as exsiccati, or informal splitting of a specimen with colleagues, raises lectotypification problems among what commonly but sometimes erroneously are considered to be isotypes. As mentioned above, there is no way to prove exactly which part of an abundant, demonstrably three-taxon Ravenel collection actually was examined by Cooke—it may have been retained by Cooke, ending up at **K**, or it may as readily have been distributed in one of ca. 30 preparations of Ravenel's *F. Amer. Exs. 603*.

A fundamental mycotaxonomic concept is that the type of a fungus name is a fungus, not simply the totality of what is glued to a numbered sheet or enclosed in a packet of substrate material—and certainly not several unexamined units of an exsiccatus distribution. The multiplex nature of Ravenel's "*Macrosporium tomato*" gathering is one example of this problem, in this instance comprising at least three morphologically disparate *Alternaria* taxa.

Another pertinent illustration, in addition to *A. tomato*, lies in my earlier designation of the **BPI** portion of a Ravenel collection as lectotype of *Macrosporium compactum* Cooke (1878) instead of a portion presumably of the same collection at **K** (Simmons 1994; *Alt.T&V* 75). My choice as lectotype was of one fungus—*Pithomyces* cfr. *chartarum* (Berk. & Curt.) M. B. Ellis—from among a mixture of several hyphomycetes present on the specimen; the *Pithomyces* fits Cooke's description of *M. compactum* as also does his illustration of the species (Cooke and Ellis 1878). The logic of choosing the lectotype from the **BPI** portion instead of the one at **K** was challenged (Zhang and David 1996) on the premise that the portion in the herbarium of describer Cooke should have been used; an "emendation" of my lectotypification of *M. compactum* was assigned, as "Holotype," to a small-spored *Alternaria* located on the K portion—a fungus incompatible with Cooke's description and illustration.

The errors in this "emendation" of the lectotypification of *M. compactum* were in assuming that Cooke's concept of *Macrosporium* was *Alternaria*—as we now define the genus—and then in assigning to the substrate portion at K a "type" significance that can belong only to the one fungus that Cooke selected from the substrate mixture and examined closely enough to describe and draw. McClellan (1944) made the same errors when he published *Alternaria compacta* (Cooke) McClellan after examining spores "from herbarium type material" (without citing herbarium and specimen).

Since M. C. Cooke's descriptions and names of many taxa of *Macrosporium* figure here and often elsewhere in these *Alt.T&V* writings, it is noted for future reference that his concept and usage of the genus name *Macrosporium* was generous in its circumscription. For example, *M. abruptum* Cooke & Ellis (1877) is a *Ulocladium*; *M. alliorum* Cooke & Massee (in Cooke, 1888) is a *Stemphylium*; *M. caudatum* Cooke & Ellis (1878) is an *Alternaria*. In the same vein of observation and conclusion, *M. compactum* Cooke is a *Pithomyces*, not because of some rationale in choosing one portion or another of a collection but because of a successful search of the type gathering for a fungus identifiable with the type description and, in this case, with a recognizable Cooke drawing.

Many of Ravenel's collections—either assemblages of multiple specimens for exsiccati, or specimens shared with individual colleagues—abound with mixtures of hyphomycete species. Some of his exsiccati, having the theoretic status of isotypes, are insect riddled and now worthless. Many collections in "*Herb. Mycol. M. C. Cooke*" have suffered from being glued to herbarium sheets without individual protection; others have insect damage; still others are in suitable condition to serve as types—but only insofar as the described fungus can be found and identified within the characterization of the original author. Whenever one of the many specimens I have examined in the Cooke herbarium fits these criteria, I will use it for typification. If it does not, neither I nor anyone else should hesitate to search in other portions of a collection for the type fungus that meets the original protologue.

* * * * *

254. **Alternaria rugosa** McAlpine (1896), Agr. Gaz. New South Wales 7: 304. Holotype [**VPRI**]: "*Macrosporium rugosum, on tomato, Sale, 5 Feb 1896, Dr. Reid* (permanent slide no. 105)"; EGS 40-161. Fig. 176

McAlpine's description of a spreading blackmold spot of tomato fruit is the earliest to link this very common disease condition to a named species of *Alternaria*. An enlarging lesion is flat and smooth; underlying tissues of the fruit are invaded by mycelium and destroyed; and finally the surface of the lesion becomes wrinkled (*rugosa*) and covered with a dense stand of conidia.

The type of *A. rugosa* exists now only as a single slide preparation, from which Dr. Ian Pascoe at **VPRI** has furnished me drawings of several conidia. These conidia, along with McAlpine's published description of them, suggest a taxon that may be recognizable again. There is nothing in the literature to suggest that *A. rugosa* or any similar species is other than an opportunistic invader of tomato fruit. Similar tomato-fruit lesions examined over the years have yielded isolates with sporulation of the bushy *A. alternata* group pattern (Simmons and Roberts 1993), of the *A. arborescens* group (Simmons 1999), and of species with narrowly tapered beaks as in *A. tenuissima* (Simmons 1990), none of which is appropriate to what is found in *A. rugosa*.

McAlpine described sporulation as in chains of at least three [ob-]clavate, long [ob-]clavate, or oval conidia up to

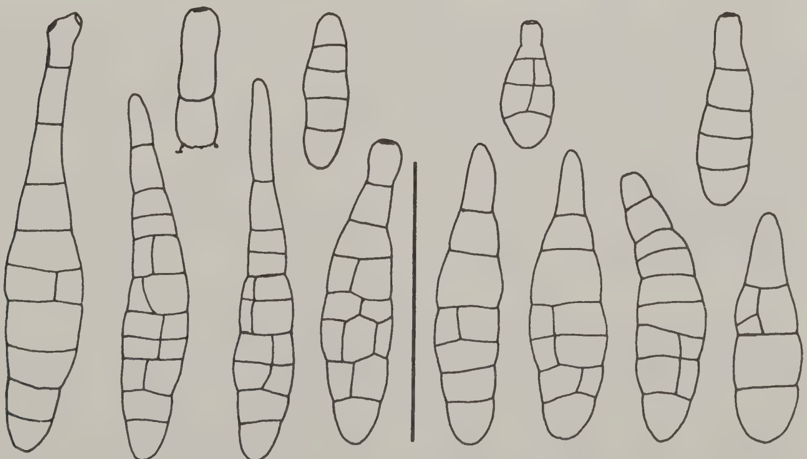

Fig. 176. *Alternaria rugosa*: conidia and conidiophore ex holotype (**VPRI**). Bar = 50μm.

79 x 11-15μm, av. 40-50 x 11-14μm, with up to 11 transepta and frequently a few longitudinal or oblique septa. His published illustration matches this description.

Measurements of conidia in the type slide are 50-70 x 11-15μm. They appear to be mostly tapered long-ellipsoid and lack a definable beak other than for the presence of short, 1-celled apical secondary conidiophores. Application of the name *A. rugosa* to modern material will remain dubious until one is found that matches the field type and original description, and then is isolated and defined in culture. At present I do not have an isolate that is appropriate for proposal as an interpretative epitype.

255. **Alternaria tomato** (Cooke) Jones (1896), Bull. Torrey Bot. Club 23: 353. Fig. 177

≡ *Macrosporium tomato* Cooke (1883), Grevillea 12: 32. Lectotype [K] (designated here): "*Macrosporium Tomato Cke. [Rav.] 3099 on ripe Tomatoes, Sept. 1880, Aiken, S.C. HWR[avenel]*"; (EGS 11-027).
≡ *Alternaria tomato* (Cooke) Brinkman (1931), De Roodneuzen-ziekte etc. (Proefschrift), p. 6.
≡ *Alternaria tomato* (Cooke) Weber (1934), Phytopath. 24: 836.
≡ *Alternaria tomato* (Cooke) Weber (1939), Florida Agr. Exp. Sta. Tech. Bull. 332, p. 22.
≡ *Alternaria tomato* (Cooke) Ciferri (1962), Atti Ist. Bot. Lab. Critt. Univ. Pavia, ser. 5, 19: 88.

Four different authors, on five different occasions, published the name *Alternaria tomato* as a combination based on *Macrosporium tomato* Cooke (1883). It is perhaps understandable that L. R. Jones' brief note published in the proceedings of a meeting of the Torrey Botanical Club (1896) might escape attention, and that A. Brinkman's university thesis (1931) on a disease of *Phaseolus vulgaris*—but also including an *A. tomato* (Cooke) comb. nov.—might not have been known widely.

However, G. F. Weber (1934, 1939) was aware of the earlier proposals. Nevertheless he recommended that the earlier combinations be dropped, arguing that the names had been misapplied—by Jones to the wrong fungus and by Brinkman to the wrong disease. Rules of nomenclature guide otherwise (Greuter et al. 1994; ICBN Art. 9): an epithet remains with its type specimen, regardless of material explored and cited—however incorrectly—by later authors. Weber's two combinations are simply synonyms of *A. tomato* (Cooke) Jones.

Weber was correct in his opinion that Jones (1896b) had discussed the wrong fungus; the Jones discussion was of an *Alternaria* with long chains of conidia rather than Cooke's long-narrow-beaked *Macrosporium tomato*. Weber's study (1939) was of a pathology called "nailhead spot" of tomato; his is by far the most extensive and discriminating treatment of the disease that exists. Nailhead spot of tomato and its incitant *A. tomato* were common in his experience and commercially important at the time.

It is curious that R. Ciferri (1962), with his comprehensive interest in mycological literature, missed all four of the preceding new combinations before proposing his own.

In any case, M. C. Cooke's *Macrosporium tomato*, typified by an *Alternaria* associated with small circular lesions of ripening tomatoes in South Carolina, is the basionym of all five, which therefore can all be discussed together. The lectotype of Cooke's name exhibits characters of a taxon that produces solitary filament-beaked conidia much smaller than those of the *A. tomatophila* of early blight of tomato (*Alt.T&V 266*) and a different pattern of conidium development and mature appearance than the conspicuously dark-septate *A. subtropica* (*Alt.T&V 256*).

The lectotype material of *A. tomato* at **K** (EGS 11-027) consists of four small sections of excised skin of tomato fruit; each section bears 1-3 circular to ellipsoid lesions ca. 2-7mm in largest dimension. Cooke's measurements for the narrow-obclavate conidia were given as 100-120 x 20-22μm, which are about right for the largest spore bodies plus the short, filiform length of broken beak remaining on almost all conidia seen in reexamination (Fig. 177). Transverse septation is 6-9 in the largest conidia; 1-2 longisepta are present in a few of the transverse segments.

It would be difficult now to define *A. tomato* on the basis of this lectotype specimen, and author Cooke managed to muddy the concepts of the species and disease by publishing an illustration of a different pathology and fungus (see final paragraph of "*Alternaria in Tomato Fruit Lesions*" above). Nevertheless, the "nailhead" pathology was destructive enough in the first one-third of the 20th century that it was studied by several U.S.A. pathologists. The disease that marred maturing tomato fruit is reported to have been of particular concern in the commercial winter trade between southern growers and northern markets in the U.S.A. USDA (Bureau of Plant Industry) pathologist J. Rosenbaum (1920a,b) experimented and wrote extensively on the disease, its *Alternaria* incitant, and (by reference) its destructive role in field and transport. His illustrations, as early as the 1920s, clearly distinguished conidia of *A. tomato* from those of the *Alternaria* pathogens of the more widespread early-blights of tomato and potato.

Later, G. F. Weber (1939) produced a definitive technical bulletin on the disease and pathogen, and left in several herbaria voucher specimens of material on which his study was based. The accepted characterization of *A. tomato* is found in Weber's work. The disease itself seems to have disappeared in the U.S.A. There has been only one report of the disease in recent years (Goode and Montgomery 1979); that occurrence was limited to a single tomato hybrid grown from seed believed to have been produced in Honduras. No specimens or cultures were saved. M. J. Goode observed (in litt. 1984, University of Arkansas, Fayetteville) that "During my 27 years of work with tomato diseases, I had never seen nail head, and was of the opinion that *A. tomato* no longer existed in this country."

The most instructive Weber specimens I have located are at **IMI** (IMI 1036; EGS 24-143) and at **NY** ([FLAS-F] 10444; EGS 06-032); both were collected in Florida. These nailhead lesions have conidia similar to those in the Cooke type that have not reached maximum development; some retain unbroken beaks in progressive stages of elongation (Fig. 177).

Conidium bodies reach an upper range of 50-65 x 12-20μm plus single filiform beaks 60-105 x ca. 2μm. Most conidia in these Weber specimens are subhyaline to pale tan, with a few reaching the "dark" that Weber recorded. Measurements of the few conidia present are approximately the same as those given by Weber to represent his sample of 100 spores from multiple lesions: 39-65 x 13-22μm plus filiform beaks averaging 82.16μm in length. Conidium bodies are ellipsoid to long-ovoid, tapering almost abruptly into a filiform beak of uniform diameter. Conidia have 6-9 transverse septa with 1(-2) longisepta in 1-5 of the transverse segments; the outer wall is smooth or sometimes inconspicuously punctulate. Beaks often have a few septa. There is no evidence of chain formation in this field material. Weber mentions this solitary-conidium character, but adds and illustrates that chains of two long-beaked conidia occasionally are produced in culture.

I have seen no living specimens or cultures of *A. tomato*, and have not succeeded in developing leads that might uncover modern sources, possibly in Central or South America or on genetically unmanipulated "heritage" tomato varieties sometimes cultivated in the U.S.A.

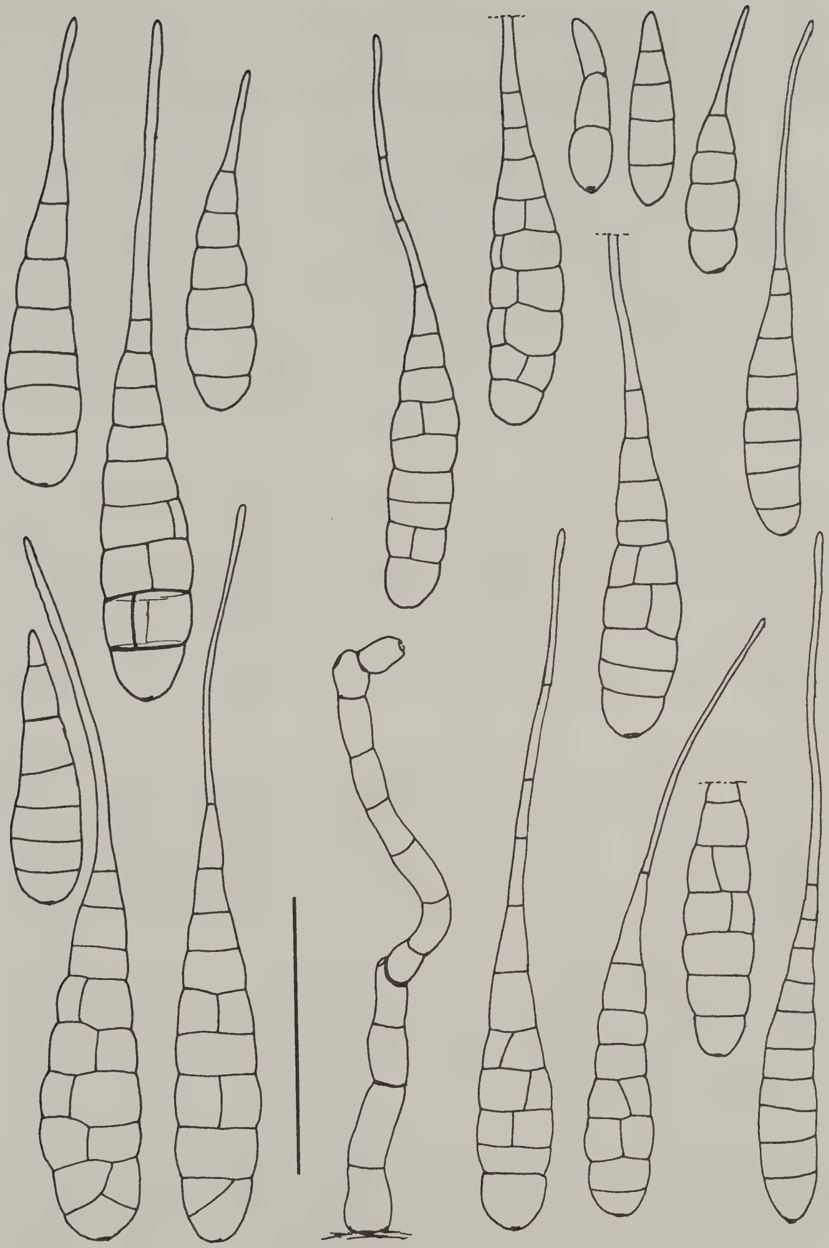

Fig. 177. *Alternaria tomato*: left of bar, conidia ex lectotype *Macrosporium tomato* Cooke (**K**); right of bar, conidia and conidiophore of *A. tomato* (Weber, **IMI** 1036). Bar = 50μm.

256. **Alternaria subtropica** E. Simmons, sp. nov. Fig. 178

Etym.: L., *sub* + *tropica*, the (northern) subtropics as the regional source of all known specimens.

Conidiophora simplicia, robusta, septata, 40-60 x 6-10µm. Conidia juventute ovoidea vel ellipsoidea, erostrata, 5-transeptata, 40-60 x 12-17µm; dein in maturitate longi-ovoidea vel late obclavata, robuste rostrata, corpore 61-88 x 22-32µm rostroque solitario, septato, 45-69 x 5-6⟶2-3µm; corpus conidiorum 7-9 transverse, 1-3 longitudine septatum, modice brunneum, laeve vel conspicue punctatum, septis valde atrobrunneis. Habitatio typi in laesionibus fructuum maturorum Lycopersicon esculentum Mill. Holotypus: ***BPI*** *0446596, specimen ex Mexico interceptum, D. E. Noel et J. M. Kaiser, Nogales, Mexico, 20.iii.1958 (EGS 47-050).*

A second distinctive *Alternaria* taxon is present in the gathering of tomato fruit-spot lesions from which the type of *A. tomato* was described (Ravenel no. 3099). This Ravenel gathering of nonidentical excised lesions was the source of some 30 exsiccatus preparations distributed in Ravenel's *Fungi Amer. Exs. 603* and of undistributed portions held at **K** (EGS 11-027, lectotype of *A. tomato)* and **NY** (EGS 48-032 to 48-037 incl., in part representing *A. subtropica*), as was discussed in detail above.

Conidia of *A. subtropica*, although produced on lesions similar to those of the *A. tomato* nailhead pathology, are larger, darker, and much more robust in general appearance than those of *A. tomato*. Ravenel collected both species in South Carolina. Additional, even more instructive specimens of *A. subtropica* are in **BPI** as vouchers of USDA-APHIS intercepts of tomato shipments from Mexico in the 1950s.

Conidiophores in field collections of *A. subtropica* are simple with a conspicuous apical hilum, rarely 1-geniculate, robust, ca. 40-60 x 6-10µm, septate. Conidia seen are solitary; there is no evidence of chain formation by way of secondary conidiophores.

Sporulation in the type shows distinctive steps in development of conidia from initiation into maturity. Juvenile conidia are ovoid or ellipsoid, ca. 40-60 x 12-17µm, and have 5 moderately constricting transverse septa and no longisepta or, at most, one in one transverse segment. Each conidium initially is beakless but begins to generate a narrowing apical growth when it is ca. 40µm long. As the spore body enlarges, the rather sturdy beak lengthens and gradually narrows until it is only ca. 2-3µm wide at the tip;

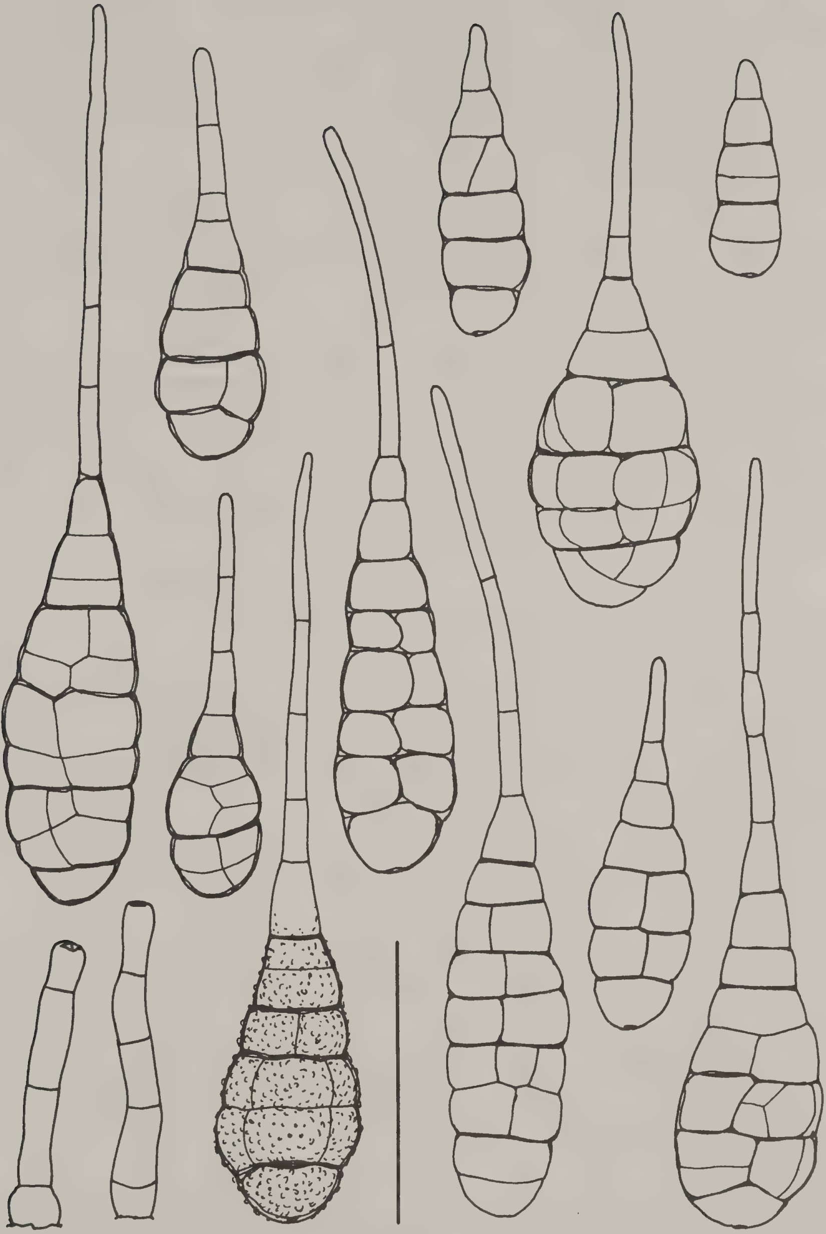

Fig. 178. *Alternaria subtropica*: conidia and conidiophores ex holotype (**BPI** 446596). Bar = 50μm.

this sturdy beak tapers and is not filiform throughout its length.

The spore body of largest conidia is long-ovoid to broadly obclavate, 61-88 x 22-32µm, and bears a solitary septate beak 45-69 x 5-6⟶2-3µm; septation is 7-9 slightly constricting transverse plus 1-3 longitudinal in 3-6 of the transverse segments. The spore body is a dull medium tan with strongly contrasting dark brown septa whose thick, dark appearance derives from the pigmented layers of a euseptum and abutting surfaces of two distosepta. The outer wall may be smooth or often is conspicuously punctate.

Known specimens of *A. subtropica* include three of six lesions in a non-exsiccatus portion of Ravenel 3099 (**NY**, Ellis Collection; EGS 48-032, 48-035, and 48-037) and three USDA intercept specimens from Mexico (**BPI** 446596, 446604, and 446611, respectively EGS 47-050, 47-052, and 47-049), all on lesions ca. 1-2 cm. diam. ex mature fruit of *Lycopersicon esculentum*. (See Appendix for specimen data.)

257–266. "Alternaria solani" auctoris
One name—several species

The most confusing problems in classification of *Alternaria* taxa on Solanaceae center on species related to foliage lesions of potato, tomato, and eggplant. These infections, usually referred to as early blight or target spot, may extend to stems, tubers, and fruit of the hosts. Conidia of the incitant fungi are relatively large: spore bodies develop into a size range of 100+ x 20-25µm and have beak extensions that may reach lengths of 50-200µm or more, differing with species and stage of conidium development.

Some literature has reported experimental variation in isolates of "*A. solani*." Emphasis, however, has been on examining the possible existence of physiologic or pathogenic strains or races. The initial assumption or eventual conclusion always has been that a single species—*Alternaria* (*Macrosporium*) *solani*—is the pathogen, whether the isolates used in a study were from potato, or tomato, or eggplant, or all three of these.

There is no body of work that specifically compares characters of sporulation pattern and conidium morphology of isolates from these three major hosts, or that treats them as other than of a single taxon. A few studies on *Alternaria* isolates from early-blight lesions have helped to establish this one-species dogma, which has not been examined, much less challenged in commonly used reference works (Ellis 1971; Neergaard 1945), and which persists unquestioned and in error in the most recent survey of the biology of *Alternaria* (Rotem 1994). A few of the early studies, nearly always cited in related literature, are summarized as follows.

Rands (1917), working with isolates from potato, tomato, and eggplant, achieved leaf lesions of various sizes in reciprocal inoculations of all three hosts as well as, to some extent, of a few other solanaceous species. On this basis he concluded "that the early blight of potato, tomato, and egg-plant are caused by one and the same organism, viz., *Alternaria solani*." Rands gave a spore size range of 120-296 x 12-20μm for spores from typical early blight lesions on potato leaves (104-184 x 14-18μm on potato agar), but presented no comparative measurements for spores from other hosts.

Rosenbaum (1920) readily distinguished conidia of what he called "*A. tomato*" (on tomato fruit) from the larger-spored species of early blight, but made no further morphological distinctions.

Bonde (1929) worked only with isolates from potato. He concluded that great differences in infectivity and virulence exist among them, but reported no comparisons with isolates from tomato.

Henning and Alexander (1959) worked only with isolates from tomato. They concluded that evidence of physiologic races of "*A. solani*" exists, but made no comparative study with isolates from potato.

Rotem (1966) examined several characters—morphology, physiology, and infectivity of isolates from early blight of potato, tomato, and eggplant—in an attempt to clarify the concept of races in *A. solani*. He concluded that the great variability within strains, and differences between strains, make "division into definite races unjustified." Rotem did not list the specific host origin of the many isolates he studied (with one exception), but simply assumed from the beginning that a single *Alternaria* species was under consideration. However, his data on infectivity/virulence, as presented in his Fig. 2 (l.c., p. 53), show very striking differences for some isolates inoculated on potato, tomato, and eggplant. The differences are great enough to suggest taking a closer look at the responsible fungi as morphologic, possibly segregable entities.

The conviction that a single morphological species, *Alternaria solani*, is the common incitant of diseases of several major solanaceous crops arose most strongly in the cross-inoculation work and results of Rands (1917). This conviction has not been disputed or refuted in any subsequent report or in derivative literature on the *Alternaria* /Solanaceae relationship. Now is the time to do so—on the basis of numerous isolates compared in controlled culture under conditions appropriate to *Alternaria* research.

I do not doubt that experimental infections can be induced in heterospecific solanaceous hosts, as Rands demonstrated. Nor would I be surprised to be shown examples of natural infections that are exceptions to the multiple-taxon conclusions I have reached for "*A. solani* auctoris." Nevertheless, I expect to show below that the previously held one-species concept actually is a misunderstanding of the pertinent *Alternaria* pathogens of at least potato, tomato, and eggplant. Available specimens, both classic and modern, as well as an abundance of modern isolates from diverse locales support the following summary of at least three taxa and names, which then are discussed separately in detail.

: 257. *Alternaria beringelae* Simmons, on eggplant; a new name for a species originally called *Sporidesmium melongenae* Thümen (1881), whose epithet cannot now be combined in *Alternaria* because of the nomenclaturally preemptive *A. melongenae* Rangaswami & Sambandam (1961).

: 258-265. *Alternaria solani* Sorauer (1896, with its many synonyms); the correct name for the major and widely distributed potato pathogen (leaves, stems, tubers).

: 266. *Alternaria tomatophila* Simmons, for the species found most commonly in scores of tomato early blight specimens that I have examined—as sporulating fresh lesions, as pure-culture isolates, and as conserved herbarium material.

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257. **Alternaria beringelae** Simmons, nom. nov. Fig. 179-180

Etym.: Port., *beringela*, the common name of *Solanum melongena* in Coimbra, source of the type; derived from Arabic *al-badhinjan*, as are many common names for eggplant, incl. *alberginia* (Catal.), *aubergine* (Fr.), *badinjan* (W. Ind.), *baranjely* (Malagasy), *berenjena* (Sp.), and *brinjal* (India).

≡ *Sporidesmium melongenae* Thümen (1881), Instituto, ser. 2, 28: 225 (non *Alternaria melongenae* Rangaswami & Sambandam (1961); see *Alt.T&V* 276). Holotype [B]: "*In Solani*

Melongenae Lin. foliis vivis. Coimbra in horto botanico. 9.79. N.o714. Leg. Moller"; (EGS 10-091).

Thümen described conidia as being long clavate with a rounded apex and a long, narrow pedicel—a common misperception of his period which, on reviewing the specimen, must be interpreted as long obclavate with a rounded base and a long filamentous beak. He reported spore body size as 60-75 x 14-18μm, with 7 transepta and 0-few longisepta. On reexamination of the type, most conidium bodies are found to have those dimensions (and up to a rare max. 80-100 x 22-25μm), with as many as nine transepta and one longiseptum in 1-5 of the transverse compartments. A narrow beak present on the largest conidia seen in the type specimen invariably is broken, so total beak lengths in type conidia remain unknown.

Conidia of the holotype of *A. beringelae* and Thümen's description immediately bring to mind other taxa of what I consider to be a group of morphologically similar species on Solanaceae. Included are *A. solani* Sorauer on potato and *A. tomatophila* causing the very widespread early blight disease of tomato (see *Alt.T&V* 258 and 266 below).

"*Alternaria* early blight" specimens that have been available for study almost always have been labeled *A. solani*, regardless of the host species. Thümen's name *S. melongenae* did not come into use for the eggplant pathogen, nor can I find that it has ever been considered elsewhere in *Alternaria*-related literature except for compilation by Saccardo (1886).

But considered it must be, for both taxonomic and nomenclatural reasons. If *S. melongenae* Thmn. (1881) cannot be differentiated from *A. solani* Sorauer (1896), the epithet *melongenae*, on transfer to *Alternaria*, would take precedence over *solani*. Even this action against Sorauer's widely used name would not bring a solution, since *A. melongenae* (Thmn.) comb. nov., if made at this present date (it is not!), would be a homonym of *A. melongenae* Rang. & Samb. (1961), an entirely different fungus (see *Alt.T&V* 276 below). In this scenario, introduction of an entirely new *Alternaria* name for the potato pathogen—however nomenclaturally correct it might be—would shock phytopathologists beyond hope of recovery.

I have no intention of pursuing the hypothetical action outlined above, for at least two reasons—the ICBN provides a method for protecting widely-used but threatened names (Greuter et al. 1994; ICBN Art. 14, 56); and, more importantly (and some pathologists still will grumble), I believe that *A. beringelae* (≡ *S. melongenae* Thmn.) is a different species than *A. solani* Sorauer, and that it needs to be established as distinct in order to correct its long history of misidentification.

This conclusion is based only partly on the type itself, which, like many type specimens, is only marginal in characterizing the natural taxon. The decision is based more broadly on several existing field specimens on eggplant that, in combination, give a distinguishing picture of the taxon. I know of no living culture of this species.

Field conidia of the type specimen of *A. beringelae* have long ellipsoid spore bodies 75-85(-100) x 18-25(-27)μm. Narrow beaks on a few immature conidia are as long as 60-75μm. Conidium septation in a meager sample is up to nine transverse and one longitudinal in 1-5 of the transverse segments.

Other eggplant field specimens show enough diversity in the progressive development of conidia that they cannot be considered to represent a single *Alternaria* taxon. Within this diversity, some Florida collections of G. F. Weber have young conidia similar to those of typical *A. beringelae* as well as better developed ones whose spore bodies are as large as those of *A. solani* and *A. tomatophila*.

Considering only field specimens, it is the apical beak structure that gives an initial clue to differences among these taxa. The beak of *A. tomatophila* conidia narrows quickly after it is initiated and remains 2-3μm in diameter throughout its straight to undulant length, which in nature commonly is up to 150μm.

In contrast, the beak of *A. solani* is ca. 5.0-7.0 at its point of origin and narrows gradually, not abruptly, through its straight to slightly curved length, which commonly is relatively short in nature, ca. 50-90μm. Even when the beak of *A. solani* is longer, as it is on a few conidia of the type of *M. solani* Ell. & Martin (up to ca. 140μm), the character of a broad base narrowing gradually throughout its length is maintained. The beak of *A. solani* may be as narrow at its tip (2-3μm) as is the entire *A. tomatophila* beak, but it is not narrowly filiform throughout.

The beak of *A. beringelae* conidia follows the pattern of *A. solani* in that it gradually narrows from a relatively broad base and shows a sturdy taper without becoming narrowly filiform; beak length, however, may reach 150-240μm.

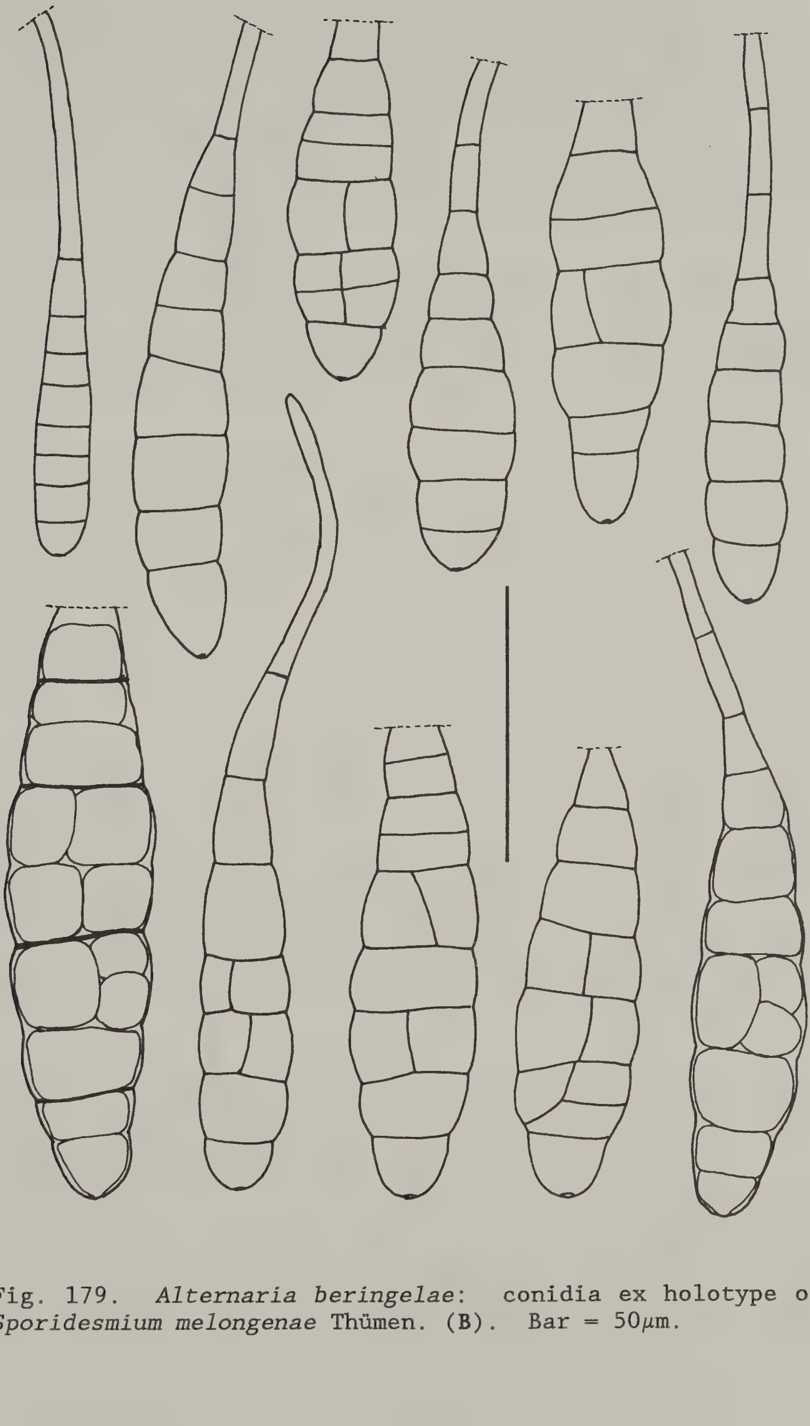

Fig. 179. *Alternaria beringelae*: conidia ex holotype of *Sporidesmium melongenae* Thümen. (B). Bar = 50μm.

The spore body of *A. beringelae* ex-type field conidia reaches 75-85(-100) x 18-25(-27)µm, plus its narrowing beak (EGS 10-091); in representative Weber specimens from Florida, the spore body reaches 88-114 x 21-30µm, plus narrowing beaks 96-175(-240)µm. There are 10-11 transepta and 1(-2) longitudinal septa in 5-7 of the largest conidia. Weber specimens supporting these observations on *A. beringelae* include EGS 45-196 (**FLAS**-F13532) and EGS 45-203 (**FLAS**-F22127). (See Appendix for specimen data.)

Although well-developed conidia of *A. solani* field specimens have spore bodies that may reach 110-125 x 20-26µm, their narrowed beaks are comparatively short in any given specimen. Beaks generally measure ca. 30-90µm, very rarely reaching 140µm in length, and therefore typically are shorter than those of *A. beringelae*.

It is hazardous to make species distinctions in this large-spored group on the basis of field specimens alone. Nevertheless, the conidial features of Florida eggplant specimens are similar enough to those of the type specimen of *A. beringelae* (syn. *Sporidesmium melongenae*), and sufficiently different from field specimens of *A. solani*, that I propose to maintain them separately. Only comparison of relevant isolates from eggplant (of which I have none) with the abundant isolates of *A. solani* on hand can lead to an unequivocal conclusion.

Several additional field specimens of large-spored, long-beaked *Alternaria* on *Solanum melongena* are held in herbaria **BPI**, **FLAS**, and **IMI**. A few of these are very similar to *A. beringelae*—a few others, particularly some from Africa, less so. It seems prudent to delay opinions on most of these until some isolates of similar taxa become available from eggplant leafspot lesions. Only one specimen among this miscellany from eggplant is morphologically distinctive enough to be described as novel on the basis of its field characters; see *Alt.T&V* 286 below.

258. **Alternaria solani** Sorauer (1896), Zeitschr. Pflanzenkr. 6: 6. Taf. I. Lectotype (designated here): illustration in Sorauer, l.c., Taf. I, Fig. 2, "*Stämmchen der Alternaria von einem feucht erhaltenen erkrankten Blattstück der Kartoffel.*" Fig. 181-182

= *Macrosporium solani* Ellis & Martin (1882), Amer. Nat. 16: 1003. See *Alt.T&V* 259.
= *Alternaria solani* (E. & M.) Jones (1896), Bull. Torrey Bot. Club 23: 353. See *Alt.T&V* 260.

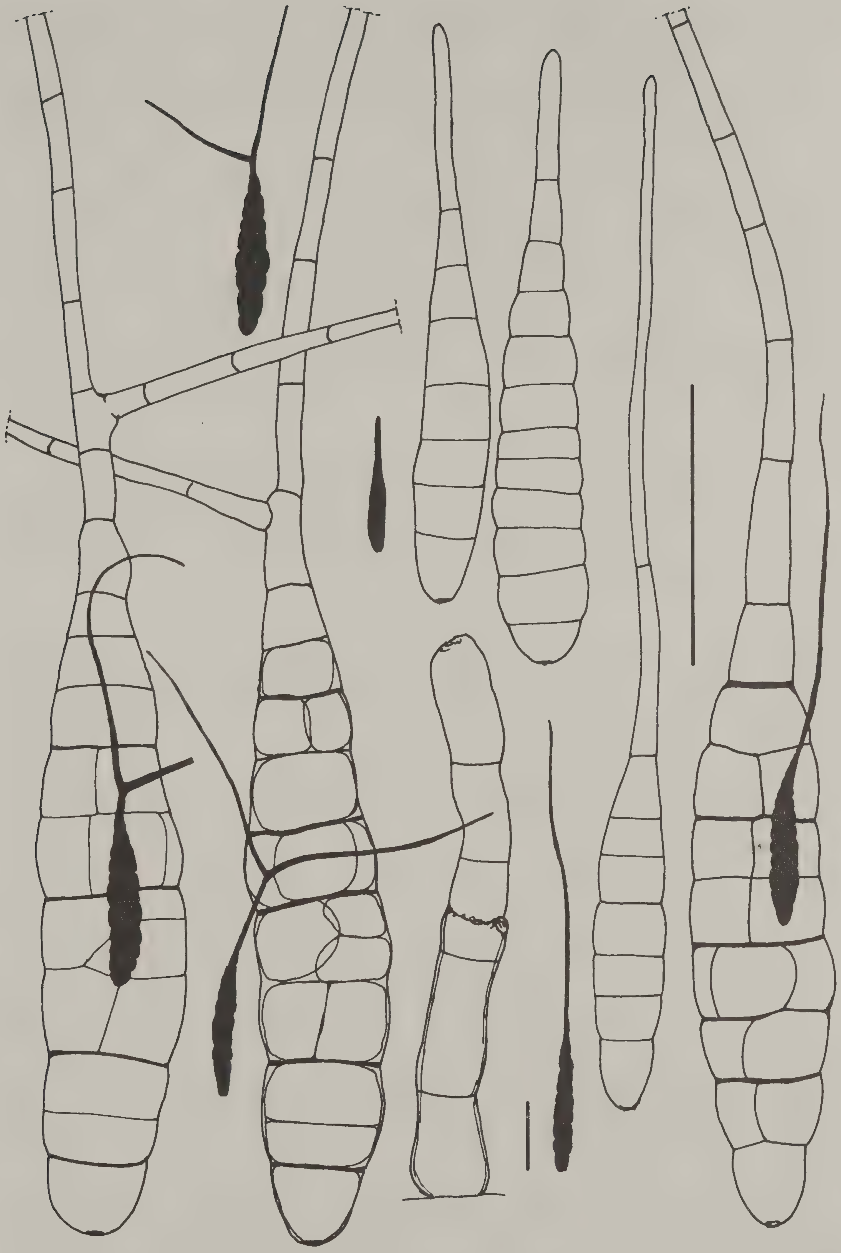

Fig. 180. *Alternaria beringelae*: conidia and conidiophore ex Weber 6081 (**FLAS**-F13532). Bars = 50μm.

= *Alternaria solani* (E. & M.) Sorauer, in Jones and Grout (1897), Bull. Torrey Bot. Club 24: 257. See *Alt.T&V* 261.
= *Alternaria solani* (E. & M.) Jones & Grout, in Jones and Orton (1899), 12th Ann. Rept. Vermont Expt. Sta., p. 179. See *Alt.T&V* 262.
= *Sporidesmium solani[-]varians* Vañha (1904), Naturw. Zeits. Land- und Forst. 2: 117. See *Alt.T&V* 263.
= *Alternaria americana* Sawada (1931), Govt. Res. Inst. Formosa, Dept. Agr., Rept. no. 51, p. 117; nom. nov. for *A. solani* (E. & M.) Jones & Grout (1899), non *A. solani* Sorauer (1896). See *Alt.T&V* 264.
= *Alternaria porri* (Ellis) Neerg. f.sp. *solani* (E. & M.) Neerg. (1945), Danish Species of *Alternaria* and *Stemphylium*, p 234. See *Alt.T&V* 265.
= *Alternaria dauci* (Kühn) Neerg. f.sp. *solani* (E. & M.) Neerg. (1945), op. cit. p. 234. See *Alt.T&V* 265.
= *Alternaria porri* (Ellis) Sawada f.sp. *solani* (E. & M.) Neerg. (1945), op. cit. p. 560. See *Alt.T&V* 265.
= *Alternaria dauci* (Kühn) Groves & Skolko f.sp. *solani* (E. & M.) Neerg. (1945), op. cit., Addit. p. 2. See *Alt.T&V* 265.

The long synonymy attached to the name of the *Alternaria* incitant of early blight of potato is tortuous, almost torturing. It reflects efforts to retain and attribute the introduction of the epithet "*solani*" by Ellis and Martin (1882) to a distinctive species with large, solitary, narrow-beaked conidia—*Macrosporium solani*—and to downplay the 1896 "*solani*" usage introduced by Sorauer for what nearly everyone except Sorauer recognized as a mixture of two quite different species of *Alternaria*, a large-spored one and a small-spored, chain-forming species, both under the name *A. solani* Sorauer.

Sawada (1931) came close to cutting the nomenclatural knot by selecting *Macrosporium solani* E. & M. (in the combination *A. solani* (E. & M.) Jones & Grout) for a "large-spored" taxon, and by renaming it *A. americana*. At the same time he assigned the name *A. solani* Sorauer to a "small-spored" taxon. Sawada's opinion was based on misleading spore measurements derived from the literature. His nomenclatural solution cannot withstand close inspection. See *Alt.T&V* 264 below.

Neergaard (1945) submerged his "*solani*" concept as a *forma specialis* under several different species names and author attributions, without defining the taxon usefully. His nomenclature and opinion on the classification of the species have not entered successfully into literature on the fungus that causes early blight of potato. See *Alt.T&V* 265.

More influentially, M. B. Ellis (1971), when deciding on a name to use for the early blight fungus in his manual on dematiaceous hyphomycetes, opted for the oldest one in *Alternaria*, namely, *A. solani* Sorauer. Ellis knew that the name had shaky provenance in its mixed-species basis and hoped, in conversation, that I "would not rock the boat."

Ellis followed the popular tradition of assigning the name *A. solani* to nearly every relatively large-spored, narrow-beaked *Alternaria* observed on "potato, tomato, eggplant and other plants belonging to the Solanaceae" (Ellis 1971, p. 482). Ellis's illustration of *A. solani* (l.c., fig. 345) very likely was based on conidia from potato leaf lesions; clues are conidium body and beak almost equal in length, and the beaks ca. 5μm thick at the base and tapering gradually to ca. 2.5μm.

Until the date of this writing, the name *A. solani* Sorauer has remained invalid in formal nomenclature for the species causing early blight of potato: there is no type specimen, and the illustrations that could serve as type of the name are of two different taxa. However, there is no reason now to "rock the boat," for the Sorauer name can be validated by lectotypifying it on the basis of the part of Sorauer's illustration that presents characters of the large-spored, filament-beaked conidia. This I have done above, rejecting Sorauer's misinformation and the illustration of his secondary taxon with small, catenate conidia.

Most of my pre-1995 experience with material of so-called "*Alternaria solani*" was based on specimens and isolates from target-spot lesions of tomato leaves and on slide preparations from herbarium specimens of potato early blight. The tomato disease is present in mid to late summer in essentially every unsprayed U.S.A. vegetable garden I have seen and, reportedly, occurs everywhere that tomatoes are grown. Among my own isolates from tomato, the *Alternaria* taxon always has been the same, described below as *A. tomatophila* (*Alt.T&V* 266). As for typical *A. solani*, in 1995 Dr. Barbara Christ (Pennsylvania State University) shared isolates from potato plants grown in Maine, Oregon, and Pennsylvania. She also provided fresh leaf lesions from plants in her research plots, from which I obtained additional isolates. Still more isolates were obtained from diseased potato plants in California, New York, and Washington State as well as from Australia and New Zealand.

Study of dozens of isolates in controlled culture reveals that sporulation in colonies of typical *A. solani* from potato (magn. 40X or less) is readily and consistently recognizable as different from that found in isolates from early-blight lesions of tomato.

Material Used in Description & Illustration of A. solani

In the absence of a type specimen of *A. solani* Sorauer, the following observations are based on several sources, but always from potato. Emphasis is placed on a field collection made in a commercial potato field east of Wenatchee, Washington, 25 August 1996 (EGS 44-098). This collection is typical of early blight leaf lesions, which were widespread in the field. The specimen is useful for several reasons: conidia of *A. solani* in all stages of development were abundant on the lesions as collected; air-dried lesions held overnight in a damp chamber yielded large numbers of new spores suitable for 1-conidium isolation; several isolates, identical in culture, were obtained; and the total picture—from field specimen through to excellent sporulation in axenic culture—encompassed and represented admirably the range of characters found in dozens of herbarium specimens, in recent field specimens from several of the United States, and in isolates shared by several colleagues in other geographic regions mentioned above.

Field Specimen Sporulation *A. solani* (Fig. 181)

Well-defined early blight lesions in field collections often are totally devoid of *Alternaria* conidia; sometimes only a few, usually young conidia are found; or, as in the case of representative EGS 44-098, individual lesions may exhibit abundant sporulation, from juveniles—still hyaline and only faintly transeptate—through to well-developed conidia with numerous transverse and longitudinal septa and a characteristic narrow but relatively sturdy beak extension.

Juvenile conidia of *A. solani*, when ca. 50 x 12μm in size, are long-ovoid, sometimes almost wedge-shaped before the beak extension is initiated. At this stage they have a few faintly-defined transepta (3-6) and are hyaline or dilute-stramineous in color. Conidia then enlarge, both in length and width, but retain a long-ovoid shape throughout development; the beak that was initiated at an early stage also elongates and maintains a relatively broad rather than filiform taper. The bodies of fully-developed field conidia commonly reach dimensions of ca. 90-100 x 18-24μm; have as many as 10-11 transepta and 1-2 longisepta in 5-8 of the transverse segments; and are smooth and medium straw-colored, with 5-6 of the major transepta darker and slightly constricting. The beak extension becomes ca. 5-8μm wide at its site of origin from the conidium body—a juncture that sometimes is evident as a slight but distinctly hipped break in contour in both juvenile and a few but not all large conidia. Beak length in the Wenatchee field material is ca. 40-80μm; beak length in other field material commonly is about the same, although lengths up to 150μm have been seen.

Large numbers of *A. solani* field specimens examined as herbarium material have essentially the same pattern of conidium development. Conidia of many specimens are less well developed than the representative specimen cited above, usually being narrower and with fewer longisepta. Others have longer beaks, sometimes with a short lateral branch. For example, the type specimen of *Macrosporium solani* Ell. & Mart. (EGS 06-027; Fig. 183) has conidia with spore bodies up to ca. 90-100 x 20-28μm plus beaks (rarely) becoming as long as 140μm and sometimes having a lateral branch (usually broken in individuals seen).

Beak branching is not a prominent character in field conidia of *A. solani* but has been noted in specimens that originated in such widely separated locales as Vermont (EGS 43-110, a classic L. R. Jones collection, dated August 1892) and Florida (EGS 45-197, one of many G. F. Weber collections, dated April 1930). In these two examples, lateral branches are not longer than 25μm. Conidiophores of field specimens tend to be near 50 x 10μm in size, with a single apical conidiogenous locus or with 2-3 pigmented hila terminating poorly defined geniculate extensions.

Sporulation under Damp-chamber Conditions (*A. solani*)

Recent field collections of *A. solani* sporulate readily in the humidity of agar plates. Leaves of the Wenatchee collection (as well as others), held overnight under such conditions, furnished new conidia in all stages of development, the majority in a size range of 225-330 x 16-35μm, which is about 50% longer than those in field or culture. Single conidia, selected by needle from fresh sporulation, have been the source of all isolates discussed here.

Descriptions from Cultures (*A. solani*)

Stable isolates of *A. solani* are easily distinguishable from isolates of every other ex-Solanaceae taxon I have handled. Every culturally stable isolate from potato leaf or tuber that I have received or made myself, beginning in 1995, sporulates readily on potato-carrot agar, V-8 juice agar, and hay-decoction agar under the simple light, temperature, and humidity protocol noted in the introduction of these notes. No extraordinary or additional manipulation of

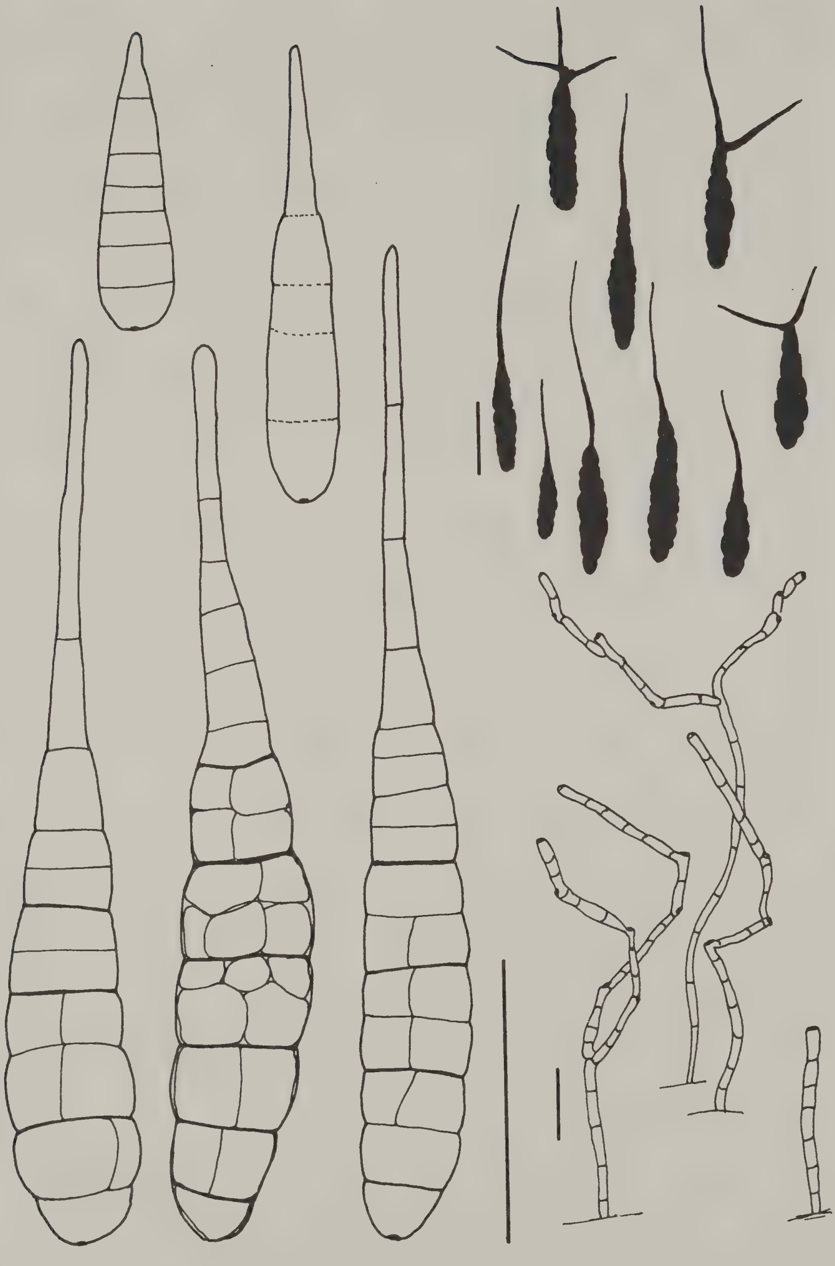

Fig. 181. *Alternaria solani*: left of bars, fresh field conidia ex EGS 44-098; right of bars, conidia and conidiophores from EGS 44-098 on V-8. Bars = 50µm.

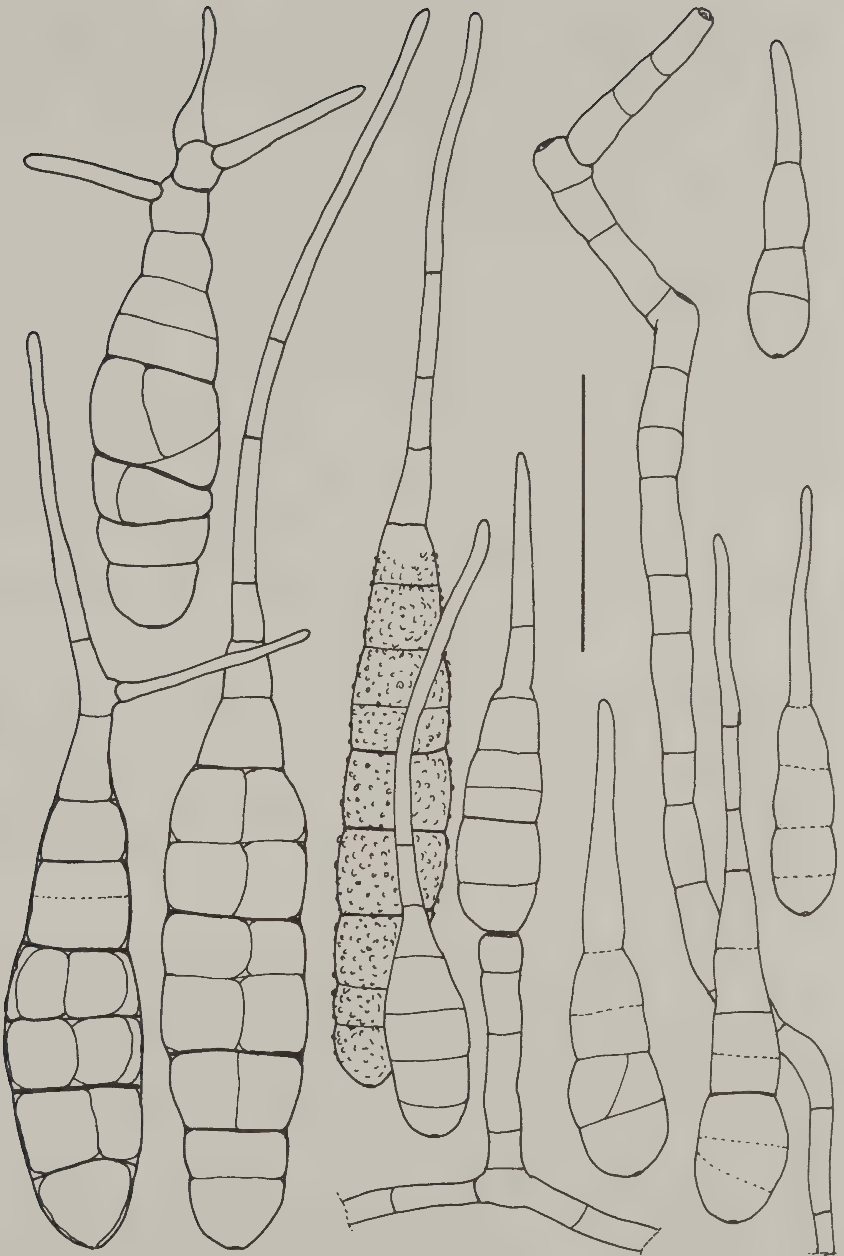

Fig. 182. *Alternaria solani*: conidia and conidiophores from EGS 44-098 on V-8. Bar = 50μm.

the colony is required—neither wounding of the mycelium nor exposure to radiation other than that present in commonly available fluorescent lamps. (I use two 15W Daylight tubes at ca. 25cm. for routine bench work; two 40W Cool White tubes at 40cm. for controlled comparisons).

The sporulation pattern of *A. solani* is striking on V-8 agar, where conidiophore production and an initial flush of conidia are excellent and crowded on surface and aerial hyphae by the 4th day of colony development. By the 6th day, conidiophores have become remarkably branched and geniculate, bearing as many as 3-9 large, rostrate conidia in tufts that are clearly discernible at 50X magnification. The sporulation pattern on PCA is the same as that on V-8, although fewer (though still very abundant) tufts are formed. Even on Hay, the conidial tuft character predominates at 7-10d., with small uncrowded conidial clumps arising wherever the sparse radial surface hyphae develop. A non-routine trial on cornmeal agar has given results identical with those on PCA: a close stand of conidiophores and conidia on young 2-day colonies; masses (many thousands) of conidia at 4d.; and at 9d the characteristic tufts of conidia near the colony margin, where the agar gradually had been losing moisture.

Representative stable isolates of *A. solani*—under quite simple controlled conditions of culture, as defined above—produce tens of thousands of well-formed conidia on the V-8 agar in a 26 sq.cm. sector of a Y-plate within 7 days. The population is dominated by conidia with a single tapering beak. Also present are large numbers of conidia with two beaks. Conidia with three beaks are present but rare; these latter actually are spores with two beaks, one of which has produced a short branch.

Production of chains of two conidia occurs rarely in *A. solani*. Examples can be found in both field samples and cultures on PCA and V-8—practically never in most cases but readily in a few isolates. As examples, an isolate from New Zealand (EGS 45-053) has a decided tendency to produce conidia whose initial beak can become converted into a secondary conidiophore with 1-4 geniculate conidiogenous sites; and an isolate from a potato tuber in California (EGS 45-020) frequently has conidia that generate a secondary conidiophore from a lateral body cell or at the tip of a beak extension. Instead of multiplying through chain production, enormous numbers of conidia arise due to the ability of individual primary conidiophores to branch and to proliferate through series of geniculate conidiogenous extensions.

Primary conidiophores are quite variable in length when they produce an initial apical conidium. Ordinary examples include lengths of ca. 150-200µm, after which geniculation and branching of the conidiophore itself typically take place. Subsequent 3-9+ conidiogenous sites give rise to a radiate cluster of conidia. The branching conidiophore apparatus of *A. solani* in culture has a sturdy, angular appearance; diameters of the branches and extensions are ca. 9-11µm. The brown pigmentation of conidiogenous sites—the hila—contrasts with the dilute yellow-brown of the septate conidiophores themselves.

Conidia of *A. solani* are basically ovoid, but in variations of long, short, broad, and narrow. In general, conidia with a single beak are comparatively long-ovoid or -ellipsoid whereas those with 2-3 beaks are shorter. Continuing with the Wenatchee isolate (EGS 44-098) as representative (V-8, 7d), conidia with one beak commonly reach a size range of 109-115 x 18-26µm plus beak lengths of 80-118µm (noting that beaks may be as long as their spore bodies but usually are shorter in culture); beak width tapers gradually from 5-8µm to a tip ca. 2.5µm in diameter. Conidia with two beaks reach sizes of 80-106 x 16-21µm plus an initial beak 58-88 x 5⟶2.5µm and a second beak 64-88 x 4⟶2.5µm.

Conidium septation commonly reaches 7-11 transverse, with 1(-2) longitudinal in a few of the transverse compartments. The 4-5 primary transepta of large conidia are slightly darker than the secondary ones, which, like the longisepta, often are inconspicuous and obscured by a conidial surface layer of punctulate to strongly punctate ornamentation. Conidium bodies are dilute, translucent straw-colored.

Is *A. solani* restricted in nature only to *Solanum tuberosum*? From the evidence of available specimens and cultures, the answer is "almost but probably not quite." I decline to cite likely herbarium specimens from other hosts, because of the influence of unknowable field conditions, but wish to record at least one isolate from *Solanum nigrum* (EGS 46-178). The sporulation pattern of this California isolate is essentially the same as that of isolates from potato, i.e., clusters of solitary conidia on branching conidiophores. However, the bodies of large numbers of conidia produced on V-8 remain long-narrow, almost cylindrical, 95-115 x 16-23µm, which, in the absence of similar isolates, is not sufficient difference in conidium size and shape for separation from *A. solani*. The conidium body dimensions of this *S. nigrum* isolate overlap those of *A. cretica* from the Crete *Lycopersicon esculentum* isolate; however, conidia of the *S. nigrum* isolate have the short, stubby 2-beak appearance of *A. solani* whereas conidia of the Crete isolate have very long, sinuous 1-4-branched beaks (*Alt.T&V* 268).

Are foliar lesions of "*Alternaria* early blight of potato" produced only by *A. solani*, as defined above? Some evidence indicates otherwise. Again, scores of dried herbarium specimens are suggestive but do not provide an answer. However, among *Alternaria* isolates made by me from Pennsylvania field specimens are several that produce high percentages of conidia at least 50%, often 100% longer than the upper range for typical *A. solani*; the difference in length applies equally to conidium body and to beak. There also are differences in culture and sporulation patterns. I believe that most observers, if confronted with isolates of *A. solani* and its giant cousin (and lacking knowledge of host source), would treat the two as distinct taxa. This is my position in presenting *Alternaria grandis* as a new species below (*Alt.T&V* 285).

One conclusion from this study of *A. solani* merits repetition and emphasis: not one of the scores of ex-potato isolates that I have received from colleagues or established myself can be identified by culture characters, sporulation pattern, or conidium morphology as being the commonly encountered pathogen related to "early blight of tomato," i.e., to *A. tomatophila* (*Alt.T&V* 266).

259. **Macrosporium solani** Ellis & Martin (1882), Amer. Nat. 16: 1003. Lectotype (designated here) [**NY**, Ellis Coll.]: "*in foliis Solani tuberosi 1882. del. Dr. Martin* [water-color drawing included]"; EGS 06-027. Fig. 183

At least three herbarium preparations exist that may represent J. B. Ellis's type gathering—two at **NY**, and one at **PH** as no. 641 of the Geo. Martin collection (EGS 01-040). All have essentially the same label information. The label of the lectotype indicated above also bears some measurements ("Hyphae 112 Conidia 90x15") and is accompanied by a watercolor illustration of a leaflet with target-spot lesions and several conidia attached to the substrate by narrow "pedicels," which, on examination of the specimen, prove to be filiform beaks.

The name proposed by Ellis and Martin was adopted widely for specimens of the potato early-blight fungus, not only in the U.S. (as abundant herbarium holdings attest) but also for material in widely-distributed exsiccatae that originated in Europe and North America.

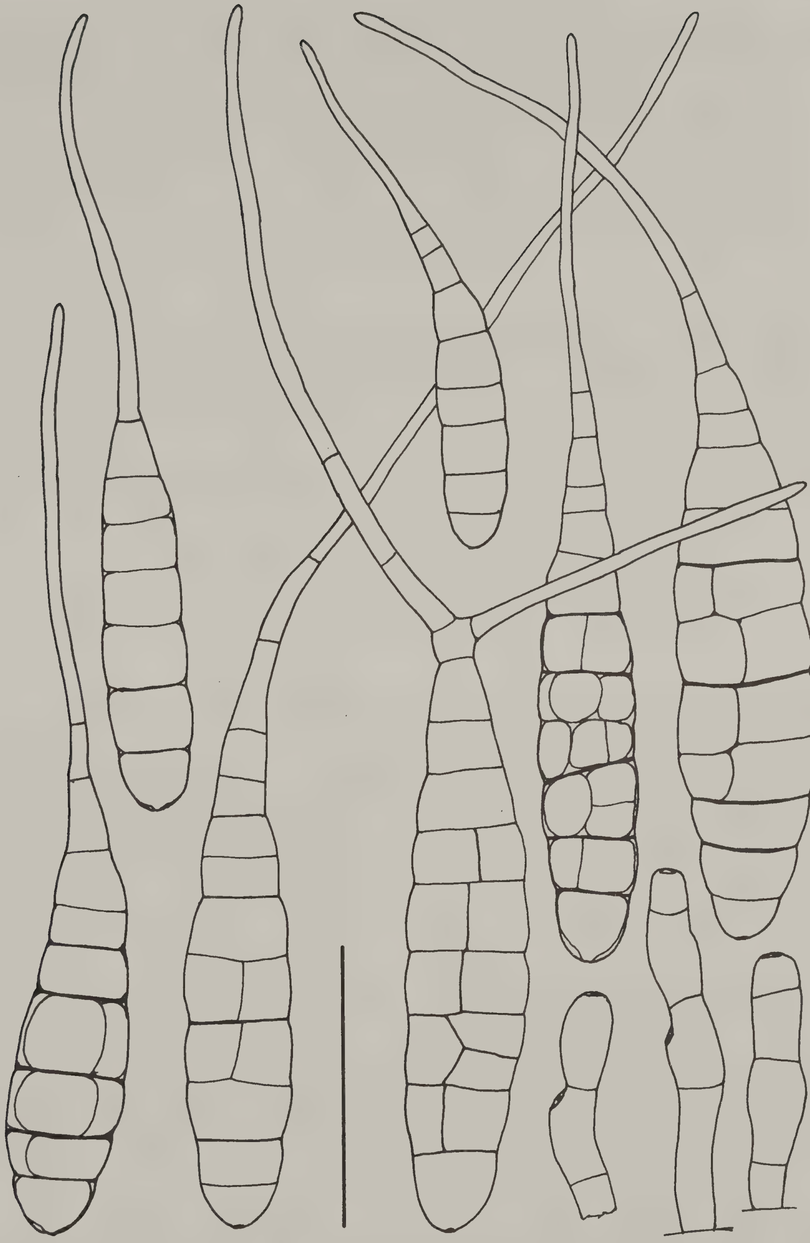

Fig. 183. *Alternaria solani*: conidia and conidiophores ex lectotype of *Macrosporium solani* Ellis & Martin (NY). Bar = 50μm.

After the publication of the name *Alternaria solani* Sorauer (early 1896), an attempt was made—primarily by L. R. Jones, a potato pathologist at the Vermont Agricultural Experiment Station—to establish and retain some sort of naming priority for Ellis and Martin in the form of *A. solani* (Ellis & Martin).... These manipulations extended at least over the period 1896-1899 (see following *Alt.T&V* 260-262). They were published before ICBN rules of nomenclature prevailed and cannot now be maintained, as *A. solani* Sorauer holds priority in *Alternaria* for this taxon.

Illustrations of lectotype conidia in Ellis's type collection are inserted here for the record (Fig. 183), although the specimen itself is no better—but certainly no less useful—than many other representatives of the species.

260. **Alternaria solani** (E. & M.) Jones (Sept. 1896), Bull. Torrey Bot. Club 23: 353.
Alternaria solani (E. & M.) Jones (Dec. 1896), 9th Ann. Rept. Vermont Agr. Expt. Sta. 1895: 86.

≡ *Macrosporium solani* Ell. & Martin (1882), Amer. Nat. 16: 1003.

In late 1896(a,b) L. R. Jones twice published an opinion that large-spored *Macrosporium solani* E. & M., as known to him, can develop spores in chains and therefore should be known as *Alternaria solani*. He disputed Sorauer's belief that a large-spored fungus on potato leaf spots and an accompanying small-spored, chain-forming *Alternaria* represented a single species, *A. solani* Sorauer.

The combination *A. solani* (E. & M.) Jones had some use in potato disease literature. However, the name *A. solani* Sorauer also was published in 1896—earlier than December (Jones, l.c., p. 85, mentioned Sorauer's earlier publication) and presumably earlier than September (Jones, l.c.). Jones (Dec. 1896, p. 86) concluded that "We will leave it for someone more expert in the matter of nomenclature than ourselves to decide upon whose authority the name rests." ICBN rules of priority operate in favor of *A. solani* Sorauer, which, as lectotypified in *Alt.T&V* 258, now is correct usage.

261. **Alternaria solani** (E. & M.) Sorauer, in Jones and Grout (1897), Bull. Torrey Bot. Club 24: 257.

≡ *Macrosporium solani* Ell. & Martin (1882), Amer. Nat. 16: 1003.

L. R. Jones and A. J. Grout, having studied much American material of potato early blight as well as specimens sent by Sorauer, pointed out the discordance between the infective large-spored *Alternaria* and a non-invasive small-spored chain-forming *Alternaria* that was commonly present on lesions. They made another attempt to retain the original *Macrosporium solani* Ell. & Mart. concept for the large-spored pathogen and to combine it with the large-spored element of Sorauer's study—proposing the format *A. solani* (E. & M.) Sorauer as a nomenclatural compromise.

However, Sorauer had maintained firmly (1896, pp. 6-7) that any relationship that might exist between the *Alternaria*[s] he had studied and the American *M. solani* E. & M. must be demonstrated through cultures from fresh American material. Sorauer did not consider his name *A. solani* Sorauer to be derived from that of the earlier *M. solani* E. & M. The Jones and Grout attribution of such a new combination to him was a good effort but resulted in another invalid name.

262. **Alternaria solani** (E. & M.) Jones & Grout, in Jones and Orton (1899), 12th Ann. Rept. Vermont Expt. Sta., p. 179.

≡ *Macrosporium solani* Ell. & Martin (1882), Amer. Nat. 16: 1003.

L. R. Jones, with W. A. Orton, held fast in his determination to include the earlier describers "Ellis & Martin" as original authorities for the name *A. solani*. Their 1899 report appears to be the first citation of "Jones & Grout" as combining authors, accompanied by a suggested synonymy of "*Alternaria Solani* Sorauer in part; *Macrosporium Solani* E. & M."

Most of the literature of late 19th and early 20th century phytopathology uses the format *A. solani* (E. & M.) Jones & Grout, presumably because of the extensive work on potato diseases published from the Vermont Agricultural Experiment Station as well as because Saccardo and D. Saccardo (1906) compiled the name in this style in Saccardo's *Sylloge Fungorum*.

It is of interest to note that Jones and his co-workers in Vermont had enlarged the scope of their attention by 1899 to include additional large-spored *Alternaria* taxa on Solanaceae. Specimens listed under *A. solani* in their 1899 report were on *Datura tatula*, *Lycopersicon esculentum*, and *Solanum tuberosum*.

263. **Sporidesmium solani[-]varians** Vañha (1904), Naturw. Zeits. Land- und Forst. 2: 117, Taf. II-III. Lectotype (designated here): illustration in Vañha, l.c., Taf.II, fig. 4, 9, and Taf.III, fig. 1-8, "*Sporidesmium solani varians (nova species) // A. Vañha ad naturam del.*"

Vañha gave detailed descriptions and illustrations of dictyoconidial fungi from what he called leaf-scorch or dry-spot disease of potato; his habit sketch of leaf lesions shows typical early-blight target spots. His elegant, somewhat stylized drawings are of at least two different taxa of *Alternaria*—the usual large-spored long-beaked species and a small-spored chain former.

Vañha's observations are similar to those of Sorauer for *A. solani*: two disparate kinds of conidia were considered to be of a single pathogen, which each author described as novel. However, in a footnote to his paper, Vañha remarked that Sorauer's paper (1896) on dry-spot disease of potato (*A. solani*) had come to his attention after the completion of his report. He concluded that the disease pictures presented by him and by Sorauer were the same and that, according to his own observations, the disease was new and that Sorauer had made correct decisions on the subject.

Although Vañha did not make a precise statement on synonymy after seeing Sorauer's publication, it is a reasonable interpretation of his footnote that, as he agreed with Sorauer on all points, he also considered Sorauer's name for the pathogen to have priority over his own. For the purpose of formal nomenclature, and following Vañha's conclusions and the lectotypification designated above, *Sporidesmium solani-varians* Vañha is simply a synonym of *A. solani* Sorauer.

Subsequent handling of Vañha's species name—as a combination in *Alternaria*—is little more than a misleading bibliographic situation. It does not merit separate handling in these notes and, on the basis of the following four entries, supports only a conclusion that the epithet "*solani-varians*" never has been published validly in *Alternaria*.

: 1915 Schander included the potato disease described by Vañha, attributed it to "*Sporidesmium Solani varians*," reproduced some of Vañha's drawings, and cited Vañha's 1904 paper. Nowhere in his 90-page consideration of the most important potato diseases did Schander use the name "*Alternaria solani varians.*"

: **1924** Bolle (p.36), in her study of diseases caused by phaeodictyic fungi, introduced the name "*Alternaria solani-varians*" without citing an author but implying that her source was Schander: "Schander nennt Alternaria Solani varians als den Erreger der Blattbräune oder Dürrfleckenkrankheit." Bolle's attribution of the combination or name to Schander is not correct; Schander performed no such action. (Bolle dated her literature source incorrectly, an error followed by Neergaard and Joly.)

: **1945** Neergaard (p. 260) synonymized *A. solani-varians* Schander in his treatment of *A. solani*, indicating that he had seen the publications of both Bolle and Schander.

: **1964** Joly (p. 184) continued the erroneous listing of a name that never has been published validly—by Schander or anyone else.

264. **Alternaria americana** Sawada (1931), Govt. Res. Inst. Formosa, Dept. Agr., Rept. no. 51, p. 117; nom. nov. for *A. solani* (E. & M.) Jones & Grout (1899) (≡ *Macrosporium solani* E. & M., 1882), non *A. solani* Sorauer (1896).

Sawada attempted to differentiate what he considered to be two *Alternaria* taxa associated with early blight lesions of solanaceous hosts. He abstracted conidium measurements published by several authors of the period 1882-1926 (Saccardo 1886, compiling Ellis and Martin 1882; Sorauer 1896; Duggar 1909; Rands 1917; Rosenbaum 1920a,b; Heald 1926). From these he chose "large-spored" dimensions ranging up to 370-407µm in length for his substitute name *A. americana*, replacing *Macrosporium solani* Ell. & Martin; and assigned the "small-spored" dimensions ranging ca. 90-140µm in maximum length to *A. solani* Sorauer.

Sawada's choice of names and conidium measurements give the impression that he had, in effect, lectotypified the two early names, yielding *A. americana* for the large-spored potato pathogen and *A. solani* for some smaller-spored species also found on potato. The impression, however, proves false, for Ellis and Martin typified *M. solani* with conidia (incl. beak) measuring 100-140 x 15-18µm, whereas Sorauer typified the largest component of his mixture with conidia (incl. beak) measuring 90-140+ x 12-20(mostly 14-16)µm. Conidium size differences of the two types are not significant, and Sawada's thesis fails.

Sawada's "large-spored" measurements were from authors who looked at considerably more specimens than did either Ellis and Martin or Sorauer. More significantly, some of these authors (e.g., Rosenbaum 1920a,b) introduced the fallacy of considering several diseases to be caused by the same species of *Alternaria*—notably, early blight of potato (*A. solani*), early blight of tomato, tomato fruit spots, and tomato foot rot. Thus, Sawada's interpretation was based on conidium-size data derived from at least three different *Alternaria* species. This error, introduced by authors other than Sawada, has not been corrected to date by any subsequent student of these diseases or of the *Alternaria* species that cause them.

Sawada's "*Alternaria americana*" should be treated as a *nomen ambiguum*. Its typification base is unknown or, at best, is derived from a compilation of conidium measurements from miscellaneous literature sources.

265. **Alternaria porri** (Ellis) Neerg. f.sp. **solani** (E. & M.) Neerg. (1945), Danish Species of *Alternaria* and *Stemphylium*, p 234.

Alternaria dauci (Kühn) Neerg. f.sp. **solani** (E. & M.) Neerg. (1945), op. cit., p. 234.

Alternaria porri (Ellis) Sawada f.sp. **solani** (E. & M.) Neerg. (1945), op. cit., p. 560.

Alternaria dauci (Kühn) Groves & Skolko f.sp. **solani** (E. & M.) Neerg. (1945), op. cit., Addit. p. 2.

Neergaard, in his treatment of "*A. solani*" from several solanaceous hosts, introduced a system of *formae speciales* for what he considered to be morphologically indistinguishable fungi that had become specialized pathogens of onion, carrot, potato, and tomato. The *ff. spp.* categories he introduced for "*A. solani*" are listed here as he presented them, although in formal nomenclature their epithets do not carry author names or priority status (Greuter et al. 1994; ICBN Art. 4, N3,). Neergaard's intent throughout is obvious, namely, to retain the priority and concept of the 1882 typification of *Macrosporium solani* Ellis & Martin, now no longer tenable.

Neergaard's contention that the four pathogens of onion, carrot, potato, and tomato cannot be distinguished from each other is not pursued further here, except for a statement that I consider the four to be distinct species. The correct names respectively for the pertinent species, as treated most frequently in the literature, are *A. porri* (Ellis) Ciferri (1930), *A. dauci* (Kühn) Groves & Skolko (1944), *A. solani* Sorauer (1896), and *A. tomatophila* Simmons (2000, *Alt.T&V* 266).

266-268. Tomato Pathogens Distinct from the "*Alternaria solani auctoris*" Confusion

Three *Alternaria* taxa characterized by comparatively large conidia with long filamentous beaks are discussed here. All three are associated with and have been isolated from foliar lesions of *Lycopersicon esculentum* varieties or cultivars. The most commonly encountered one, by far, is *A. tomatophila* (*Alt.T&V* 266), with folders in major herbaria plump with collections misidentified mainly as "*A. solani.*" A second species, *A. subcylindrica* (*Alt.T&V* 267), is represented by numerous early 20th century specimens at **BPI** and **FLAS-F** and, recently, by an isolate from *L. esculentum* var. *cerasiforme* (Dunal) A. Gray (cherry tomato) in Louisiana. The third taxon, *A. cretica* (*Alt.T&V* 268), isolated from greenhouse tomato leaves in Crete, is represented here by a single excellent isolate.

266. **Alternaria tomatophila** Simmons, sp. nov. Fig. 184-186

Etym.: Nahuatl + Gk., *tomatl* + *-philos*, tomato-loving

Ex cultura in agaro V-8 descripta. Conidiophora solitaria, in colonia dispersa, simplicia, ad ca. 100-130 x 5⟶8µm, subhyalina vel modice brunnea. Conidia solitaria, anguste ellipsoidea, multitranseptata, dein longe ovoidea, parce longiseptata, 1-2 longe filirostrata, obscure dilute brunnea, pariete laevi vel punctato. Conidia unirostrata 83-114 x 16-23 (corpus) + 99-217 x ca. 2µm (rostrum); birostrata 80-117 x 17-19 + 75-192 x ca. 2µm; trirostrata 91-104 x 17-22 + 64-170 x ca. 2µm; plerumque 7-12 transverse, 1-5 longitudine septata. Habitatio typi in laesionibus foliorum Lycopersicon esculentum Mill., specimen E. G. Simmons lectum, EGS 42-156, Montgomery County, Indiana, U.S.A., 23.viii.1995. Typus: partes ex cultura EGS 42-156 desiccatae et in ***BPI*** *746447 (holotypus) et saltem in* ***IMI*** *(isotypus) conservandae.*

The point has been made in discussion of the potato pathogen *A. solani* Sor. (*Alt.T&V* 258) that the isolates from early-blight leaf lesions of potato that I have examined can be distinguished readily and consistently from isolates of *A. tomatophila*, the common and widely distributed incitant of early blight of tomato.

I do not find that this tomato pathogen ever has been described elsewhere under a name other than its misidentifications as *A. solani*. Major *Alternaria* literature has not given guidance on distinguishing between the two species (Neergaard 1945, Ellis 1971, Rotem 1994); none of it has provided "the phytopathology oriented reader with the main facts needed in a routine identification"—thus failing a major Rotem requirement. See subheading *Alt.T&V* "257-266. *'Alternaria solani'* auctoris" above for discussion of the historical basis of this traditional error.

Material Used in Description and Illustration (Fig. 184-186)

Excellent field material of foliar early blight of tomato has been readily available and familiar to me in central Indiana during frequent visits (1950+) and now in residence. Home gardens seldom escape the disease. Local market gardeners simply ignore it, since serious defoliation seldom occurs before mid summer when the tomato fruit crop has become overabundant and marginally profitable; the cost of using fungicides in a small operation would be greater than the value of increased production by healthy plants. Specimens collected in recent years in other states (Florida, Massachusetts, New York) have the same disease picture.

Early-blight lesions, often showing concentric rings of death and desiccation in enlarging leaf spots, may or may not bear conidia in nature. Under hot humid conditions (such as those present in much of North America at the peak of the tomato season), leaf lesions commonly bear abundant sporulation. Typical lesions also usually produce a fresh crop of well-developed conidia when held overnight in a moist chamber.

The original leaf specimen (EGS 42-156) which yielded the holotype of *A. tomatophila* was sporulating with conidia of many stages of development when collected (Fig. 184). Youngest erostrate conidia are lanceolate; they produce a single apical, narrowly filamentous beak, which lengthens without broadening as the spore body enlarges. Conidium bodies are basically long-ovoid, sometimes broad-ellipsoid, throughout their development. They commonly become as large as 86-122 x 24-30μm and have 8-15 fine but distinct transepta plus 1-2 longisepta in 2-5 of the transverse segments. Most field conidia have a single beak 122-144 x (5-)3⟶2.5μm. This long filiform beak narrows abruptly from its site of origin in the body apex; the character contrasts with that of the somewhat sturdier beak of *A. solani*, which typically tapers gradually from a broad base (6-8μm) to a narrow tip.

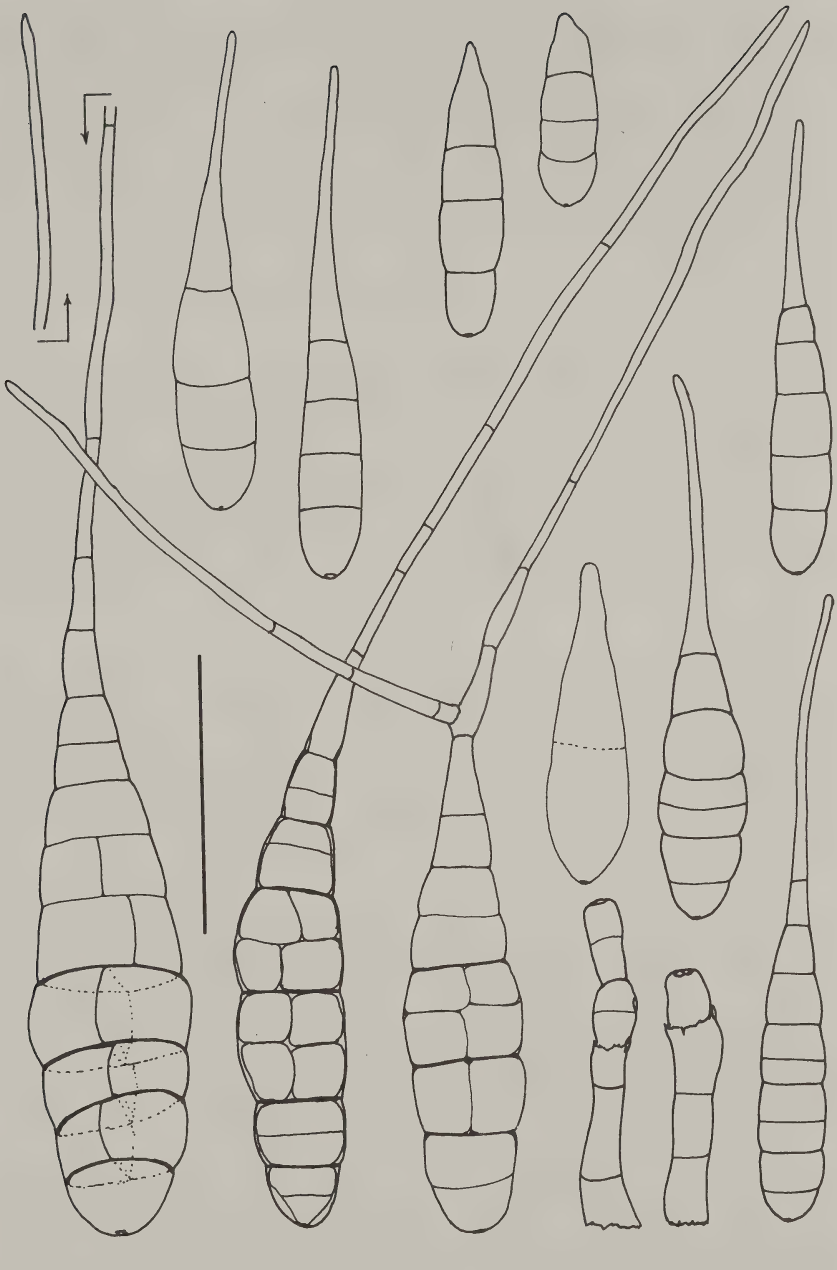

Fig. 184. *Alternaria tomatophila*: fresh field conidia and conidiophores, source of isolate EGS 42-156. Bar = 50μm.

Occasionally conidia of the field specimen have two filamentous beaks arising from the body apex—a primary one extending the longitudinal axis of the conidium and a secondary one almost at right angles to that axis. Conidium bodies with two beaks seldom are as large as those with a single beak, usually not exceeding 100 x 24μm; and their beaks tend to be relatively short, the primary one up to ca. 83-96μm long and the secondary to 58-61μm. Field conidia are a transparent pale tan with outer walls that appear to be quite smooth.

Characters in Culture *(A. tomatophila)*

The isolate chosen for preparation of the holotype is from a specimen with natural sporulation on leaves showing typical concentric rings of target-spot lesions. The initial specimen (EGS 42-156) is practically identical with other collections made by me in Massachusetts and Indiana over many years as well as with numerous herbarium specimens of this disease that have been examined. In addition, this specimen provided abundant viable sporulation that served as origin of at least 25 1-conidium isolates, of which the five best have been retained.

The term "five best," above, is used advisedly. The literature is full of remarks about non-sporulation or loss of sporulation ability in "*Alternaria solani*" cultures. Such a deficiency need not be the case with true *A. solani*, i.e., the potato early blight pathogen, which is an eminently good conidium producer in carefully-isolated, well-maintained cultures (*Alt.T&V* 258). *Alternaria tomatophila*, however, is another matter.

Even fresh isolates of the tomato pathogen, *A. tomatophila*, do not sporulate readily or abundantly on PCA and V-8 under my culturing routine—and only scantily if at all on Hay. Colonies develop well, becoming grey wooly tangles of surface and aerial hyphae ca. 2.0 cm. diam. within two days, but are without conidia at this stage on PCA. Parallel V-8 growth bears numerous conidia in the central 1.0 cm. of the colony, but not in the abundance present in *A. solani* cultures produced under the same conditions.

As PCA colonies of *A. tomatophila* age to 6-10d. (filling a Y-plate sector), conidia are produced in relatively small numbers scattered mostly in the aerial mycelium; they are more abundant near the periphery of ageing colonies. Parallel V-8 colonies at 6-10d. have similar numbers of conidia, also aerial and peripheral. *A. tomatophila* thus characteristically produces only a scattering of conidia under simple growth conditions that, when applied to *A. solani*, induce sporulation in the tens of thousands.

Physical manipulation of developing colonies of "*A. solani*" (usually *A. tomatophila* if on tomato) has been suggested as a stimulus to sporulation. Radiation in the near-UV range or exposure to direct sunlight sometimes has been recommended (e. g., Rotem 1994). I have tried but no longer use such methods because, in my experience, they induce a density of conidium pigmentation and increase in wall thickness never found in field material or in comparable conidia produced under ordinary fluorescent illumination. Conidia produced under UV radiation cannot be compared usefully with those produced under the routine protocol I have suggested. However, scarifying the surface mycelium of identifiable *A. tomatophila* colonies induces increased production of conidia within a day or two—modestly or not at all on PCA, abundantly on V-8. Conidia produced after such a procedure (Fig. 185, 186) are morphologically suitable for comparison with conidia produced in nature and in undisturbed colonies that have not been exposed to near-UV radiation.

Given that *A. tomatophila* produces relatively small numbers of conidia in unmanipulated V-8 cultures, samples of conidia from such cultures nevertheless are sufficient for comparison with those from other species produced under the same conditions. Under these conditions (7d, V-8) conidiophores are solitary and scattered in the aerial mycelium after an initial spurt of production around the site of inoculation; they are simple, rarely 1-geniculate, commonly up to ca. 100-130μm long, and they often enlarge toward their apex (5⟶8μm wide) while darkening gradually from the subhyaline hyphal origin to a medium tan tip.

Conidia produced under these standard conditions are solitary. The conidium body is narrow-ellipsoid and multitranseptate, becoming long-ovoid as the conidium body enlarges and produces a few longisepta. Filiform beaks are narrow (ca. 1.5-2.5μm) throughout their length. Approximately equal numbers of 1-beak and 2-beak conidia are produced and dominate the population; 3-beak conidia are occasional and 4-beak rare. Conidium body color is a dull pale tan; outer walls are closely punctulate to punctate overall. Ornamented walls are characteristic of ex-type isolate EGS 42-156, although the original field conidia appear to be quite smooth. Conidium ornamentation is not a constant character in cultures of *A. tomatophila*; most spores of some isolates remain smooth whereas those of other strains, including the type, are well-ornamented or variable in this character.

Upper range dimensions of *A. tomatophila* conidia with 1, 2, or 3 beaks (7d, V-8, standard conditions, colony undisturbed) are given below in the following order:

Body length x width + **Beak** length x width
Septation transverse + longitudinal.

1-beak: 83-114 x 16-23 + 99-217 x ca. 2μm
7-12 transverse + 1 longit. in 1-2 transv. segments

2-beak: 80-117 x 17-19 + 96-192 x ca. 2μm
+ 75-192 x ca. 2μm
8-12 transverse + 1 longit. in 3-5 transv. segments

3-beak: 91-104 x 17-22 + 88-162 x ca. 2μm
+ 144-170 x ca. 2μm
+ 64-145 x ca. 2μm
8-11 transverse + 1 longit. in 2-5 transv. segments

Recent isolates of *A. tomatophila* that I have examined from several sources—primarily the U.S.A. (Florida, Indiana, Massachusetts, New York) and recently Venezuela—sporulate well after scarification of mycelium of young V-8 cultures. A routine procedure is to cut a 0.5 x 1.0cm. block of colonized agar from young 1-3d. growth of a 5d. colony, removing the agar block to an agar surface outside the colony margin. Twenty-four hours later, stable isolates—including typical EGS 42-156—will have produced thousands of well-developed conidia on the cut agar surfaces. In this flush of sporulation, 1-beak and 2-beak conidia are common, 3-beak conidia dominate the population, 4-beak conidia are frequent, and even 5-beak conidia can be found (Fig. 186).

Conidia of *A. tomatophila* produced in a 24-hour flush seldom reach the maximum lengths found in those produced in undisturbed colonies. Conidium body sizes reach a predominant range of ca. 77-96 x 19-22μm plus filiform beaks in an upper length range of 96-166μm. Otherwise, conidia in manipulated colonies of stable isolates are morphologically the same as those in undisturbed growth, with 8-10 transverse septa, 1 longitudinal septum in 1-5 transverse segments, a pale tan color, and punctulate ornamentation.

It is regrettable from an *Alternaria* taxonomy viewpoint, as well as that of phytopathology, that years of attention and reams of literature on the *Alternaria* species associated with major leaf diseases of potato and tomato have failed to distinguish between the two pathogens, *A. solani* and *A. tomatophila*. Good cultures of the two—when produced under recommended controlled conditions—are separable at a

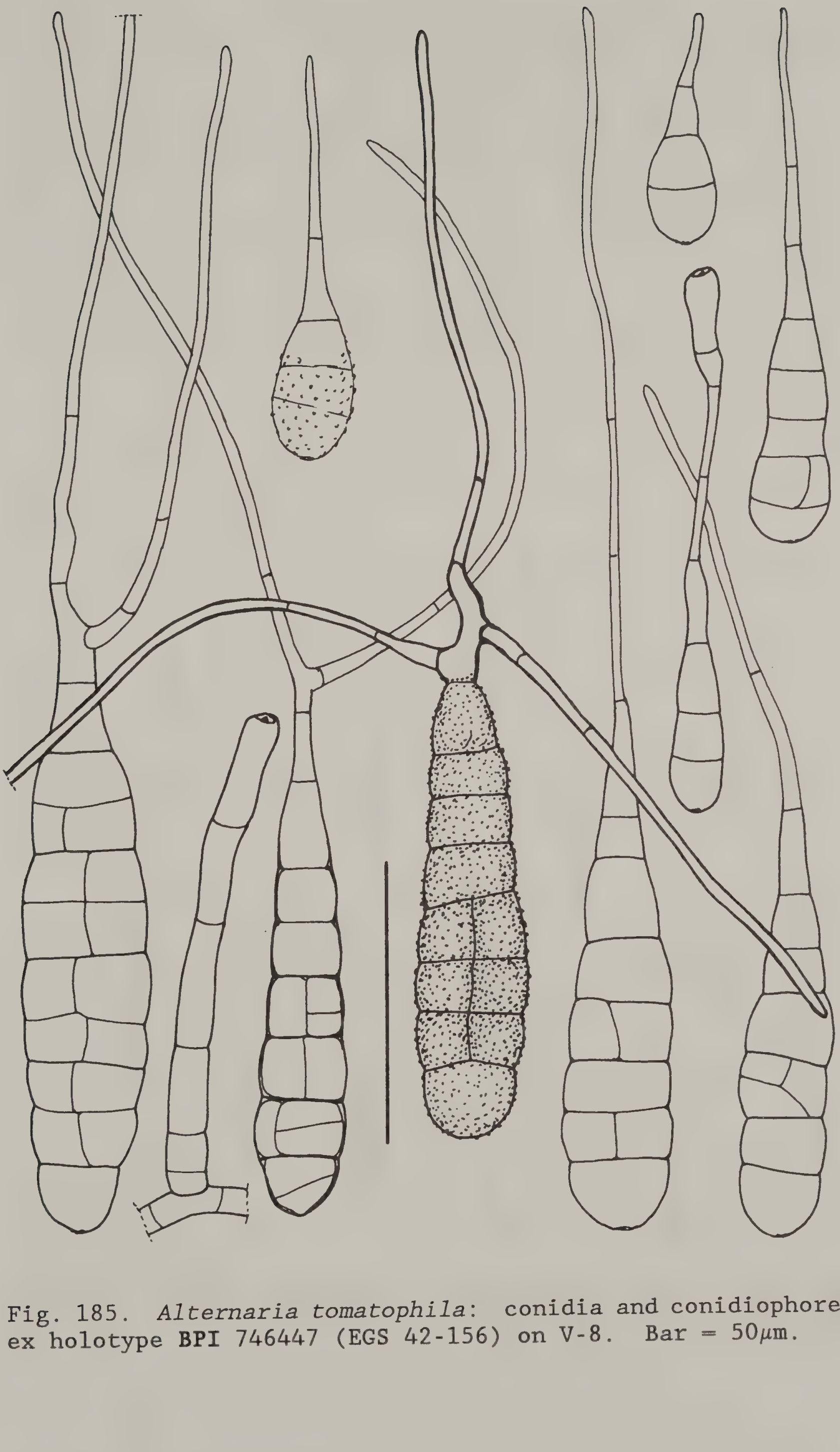

Fig. 185. *Alternaria tomatophila*: conidia and conidiophore ex holotype **BPI** 746447 (EGS 42-156) on V-8. Bar = 50μm.

macroscopic glance, even more readily at 40-50X, and definitively so at higher magnifications.

Cautious as we must be at present in interpreting molecular data based on *Alternaria* isolates, it has been refreshing to read the results of a Weir et al. (1998) RAPD-PCR molecular study of 35 isolates of "*Alternaria solani*" from both potato and tomato. Conclusions (l.c., p. 819) were that the authors had found "a significantly large genetic distance between isolates of *A. solani* from potato and tomato"—a point illustrated well by a dendrogram (l.c., Fig. 4, p. 818) that summarizes data on the number of differences in RAPD markers found among isolates from the two hosts.

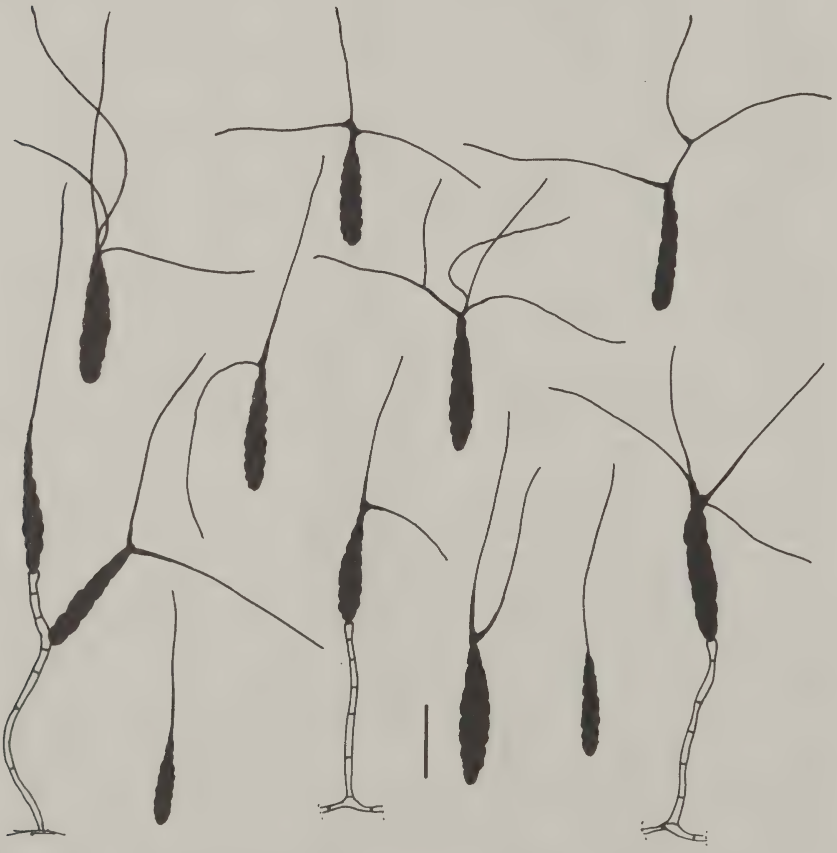

Fig. 186. *Alternaria tomatophila*: conidia and conidiophores ex holotype BPI 746447 (EGS 42-156), produced after scarification of V-8 colony. Bar = 50µm.

A study involving species-specific antigens ("ELISA detection of potato early blight agents"; Broggio and Bertocci 1995) made a similar differential point—without specific discussion—by showing (Fig. 4, p. 112) a striking difference in the selectivity of "*A. solani*" induced antisera against "*A. solani*" isolates ATCC 32904 and IMI 226598. Selectivity vs. the ATCC strain was on the order of 6-12 times greater than for the IMI strain. Notably, ATCC 32904 is an ex-tomato isolate, IMI 226598 an ex-potato isolate.

I have not managed an opportunity to examine *Alternaria* isolates from early blight lesions from a large number of extra-USA tomato-growing regions. However, every such isolate I have seen from the U.S.A. (with one exception) is *A. tomatophila*, culturally and microscopically, never *A. solani* Sorauer. The few strains seen from Australia, New Zealand, and Venezuela likewise are *A. tomatophila*. The single U.S.A. exception is discussed below as *A. subcylindrica* (*Alt.T&V* 267).

Since the work of Rotem with isolates of "*Alternaria solani*" from several different solanaceous species (e.g., potato and tomato) is widely publicized (1994), it is not inappropriate to suggest that a review of isolates from his eastern Mediterranean study area be made with the purpose of determining if only one pertinent *Alternaria* species is present—as he maintains—or perhaps more than one. A welcome by-product of such an effort, if adequately controlled, could be enlightenment on his position that "Simmons also differentiated the genus into numerous specie[s] novae, which the pathologist is not able to validate."

My obvious and supportable position, to the contrary, is that our comprehension of the range of *Alternaria* diversity and speciation still is far from adequate. My views on *Alternaria* identification and classification, and procedures for accomplishing this, are well documented (Simmons 1992). They are recommended as a working basis for validating identifications in the genus. Any pathologist who has more than a casual or routine need for an *Alternaria* species identification needs to adopt simple but informative culture procedures such as those I advocate—abandoning high-nutrient media and extraordinary radiation exposure. Furthermore, there is a need to pay closer attention to differential characters that—being no more minute than those in any other well-studied genus—are readily observable in good stable cultures. There is a necessary caution—that *Alternaria* species cannot be identified and defined positively by the lesions produced in host plants; individual species may be host selective, but not to the exclusion of other taxa.

267. **Alternaria subcylindrica** Simmons & R. Roberts, sp. nov.
Fig. 187-188

Etym.: L., *sub-* + *cylindrica*, almost cylindrical (spore-bodies of large numbers of conidia).

Ex cultura in agaro V-8 descripta. Coloniae abundanter conidioferentes. Conidiophora solitaria, simplicia aut ramosa vel 1-3 1-3 geniculata, 50-200+ x 8µm. Conidia solitaria; juventute longe anguste ellipsoidea vel subcylindrica, 1-rostrata, 30-60 x 7-9µm (corpus) + 60-100µm (rostrum), 3-9 transverse septata; maturitate vulgo longe angustata, 1-2(-3) filamentose rostrata, 8-11 transverse septata, 1-longiseptata in 1-5 segmentis transverses, ad 84-109 x 13-18µm (corpus) + 122-269 x ca. 2µm (rostrum), laevia, dilute brunnea. Habitatio typi in laesione folii Lycopersicon esculentum Mill. var. cerasiforme (Dunal) A. Gray. specimen R. G. Roberts lectum, Louisiana State University Burden Research Plantation, Baton Rouge, Louisiana, U.S.A., 2.vii.1997. Typus: partes ex cultura EGS 45-113 (ex isol. RGR 97-0057) desiccatae et in ***BPI*** *746448 (holotypus) et saltem in* ***IMI*** *(isotypus) conservandae.*

The type isolate of *A. subcylindrica*, from a leaf lesion of a cherry tomato varietal, differs from cultures of *A. tomatophila* in macroscopic colony development, sporulation pattern, and conidium morphology. This Louisiana isolate is, in fact, of a species that is represented well in **BPI** and **FLAS-F** accessions from tomato leaf lesions that originated in the period 1909-1955 in Honduras (EGS 45-177) and the U.S.A.: California, Florida, New York, and Texas (e.g., EGS 45-161, 45-173, 45-174, 45-175, 47-051, 47-060, 47-064; see Appendix for specimen data).

The 7-day V-8 colony of *A. subcylindrica*, unlike that of *A. tomatophila*, is abundantly conidial. Much of the surface growth is of conspicuous (at 40-50X) radial, branching, and anastomosing hyphae from which sturdy conidiophores arise. Although *A. subcylindrica* conidiophores are very abundant, they usually are solitary and uncrowded. They are simple with a single apical conidiogenous site, or sometimes branched, or 1-3 geniculate and conidiogenous; 50-200+ x 8µm. Conidia are solitary and openly spaced at conidiophore geniculations, an aspect that contrasts with the crowded conidial clumps characteristic of *A. solani* (*Alt.T&V* 258) and of maturing colonies of *A. cretica* (*Alt.T&V* 268).

Juvenile conidia are long-narrow ellipsoid or subcylindric; they initiate production of a filiform beak at a very early stage of development. Very young conidia with 3-9

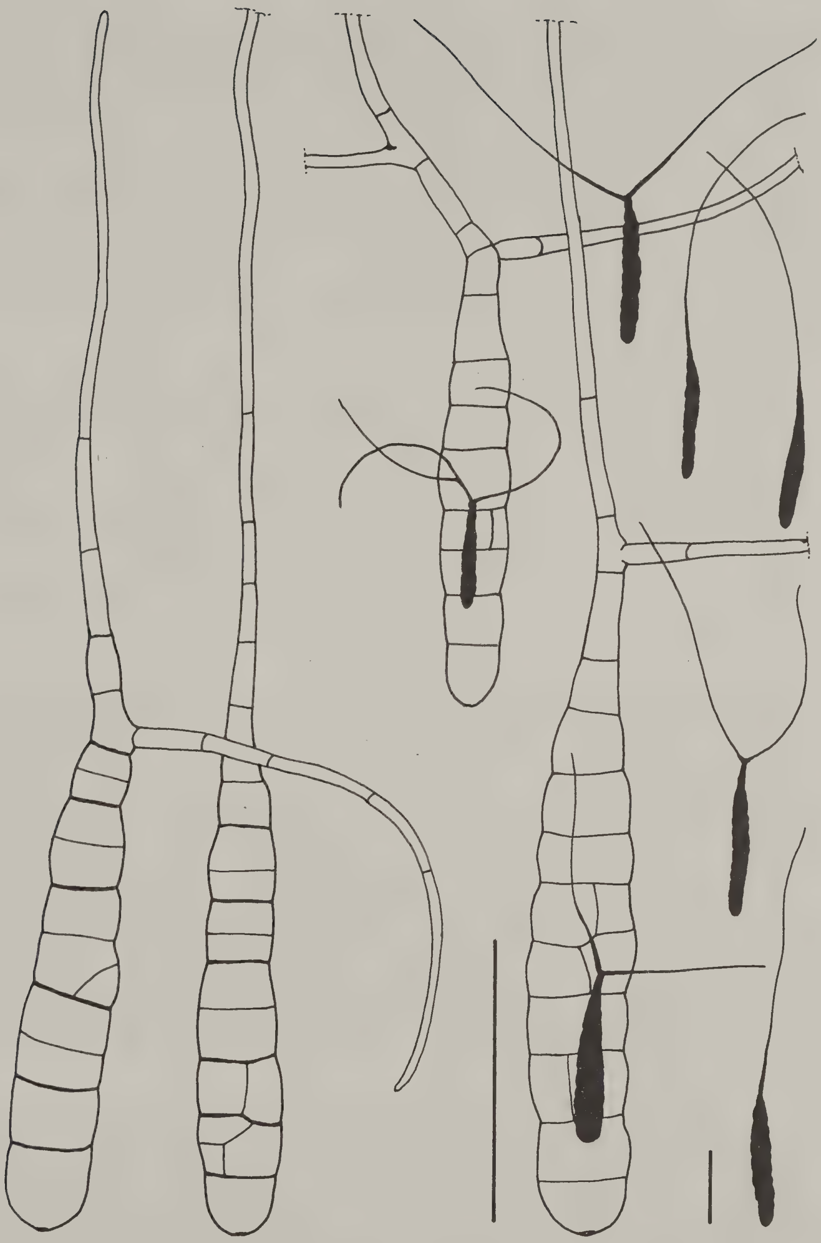

Fig. 187. *Alternaria subcylindrica*: left of long bar, conidia ex field specimen BPI 446594; right, conidia ex holotype BPI 746448 (EGS 48-049) on V-8. Bars = 50μm.

pale disto- and eusepta measure ca. 30-60 x 7-9µm (body) + 60-100µm (beak). A high proportion of developing conidia retain the long-narrow characteristic into maturity, at which time they usually have one, often two, rarely three beaks. Conidia with one beak commonly are up to ca. 84-109 x 13-16µm (body) + 154-269 x 2µm (beak), and have 8-11 transverse septa and rarely more than 1 longiseptum in only 1-2 transverse segments. Conidia with two beaks are ca. 96-102 x 13-18µm (body) + (83-)122-205 x 2µm (beaks), and have 9-10 transverse septa and 1 longiseptum in 1-5 of the transverse segments. Conidia are smooth and dilute brown, with transverse eusepta slightly darker and often moderately constricting.

Conidia of field specimens of *A. subcylindrica* (cited above) are long and narrow; they have essentially parallel sides, and miss being cylindrical because some of their transverse eusepta are moderately constricting of the conidium body. Longitudinal septa are uncommon in field conidia; a few of the constricting septa are notably dark.

268. **Alternaria cretica** Simmons & Vakalounakis, sp. nov.
Fig. 189-190

Etym.: geogr., Crete, only known source.

Ex cultura in agaro V-8 descripta. Coloniae omnino et abundanter conidioferentes. Conidiophora primaria 60-400+ x 5-8µm. solitaria aut binata; juventute 1-3 geniculata et conidiogena, postea (ca. 10 d) geniculata et ramosa, 10 sitibus conidiogenis. Conidia in maturitate vulgo longe anguste ellipsoidea sed etiam late ovoidea vel ellipsoidea, 83-110 x ca. 13-17µm (corpora angusta) ad x ca. 20-26µm (corpora lata), 9-12 transverse septata, 1 longiseptata in 1-5 segmentis transversis, dilute brunnea, laevia vel minute punctulata. Habitatio typi in laesione folii Lycopersicon esculentum Mill., in caldario, 1997, specimen D. J. Vakalounakis lectum, Plant Protection Institute, Heraklio, Crete, Greece. Typus: partes ex cultura EGS 46-188 (ex isol. D.J.V.) desiccatae et in **BPI** *746449 (holotypus) et saltem in* **IMI** *(isotypus) conservandae.*

The type isolate of *A. cretica* originated from a tomato leaf spot similar to those produced in *A. tomatophila* early blight. The source was a plant grown under greenhouse conditions in Heraklion, Greece. Although size ranges and mature morphology of conidia of *A. cretica* and *A. tomatophila* are very similar, colony development and sporulation pattern of *A. cretica* differ markedly from those of *A. tomatophila*.

The initial most striking character of *A. cretica* cultures is that colonies on V-8 and PCA are totally and

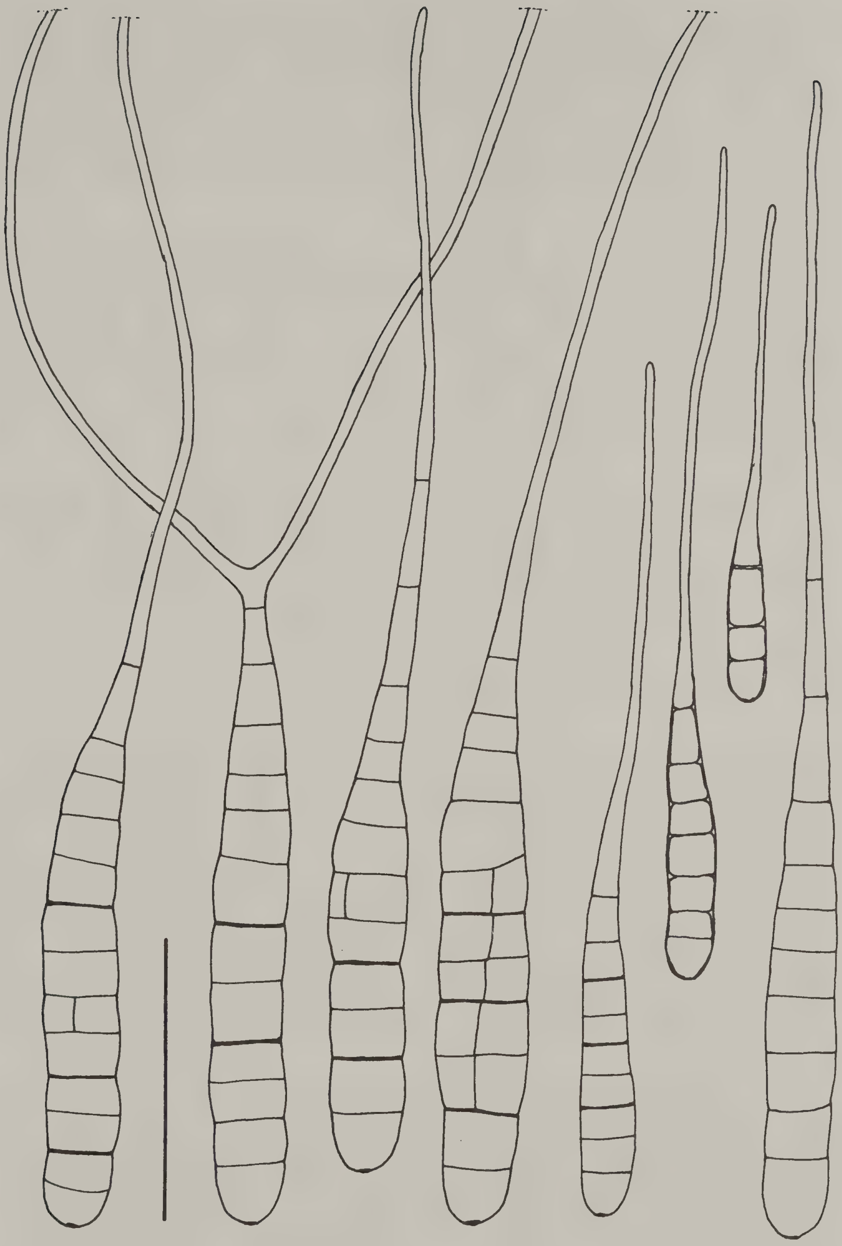

Fig. 188. *Alternaria subcylindrica*: conidia ex holotype BPI 746448 (EGS 48-049) on V-8. Bar = 50μm.

abundantly conidial from the beginning, with essentially no nonsporulating aerial mycelium; even Hay colonies produce moderate numbers of conidia. This pattern of colony development and sporulation contrasts strongly with that of the scores of sparsely sporulating *A. tomatophila* isolates cultured repeatedly in this study. See *Alt.T&V* 266 above for details of the abundantly mycelial, reluctantly sporulating nature of *A. tomatophila* in culture.

The 7-day V-8 colony of *A. cretica* shows successive daily concentric rings of surface growth and sporulation. Sporulation is dense throughout the colony, becoming only slightly less so near the colony margin where branching clumps of up to 10 conidia are conspicuous and dominant. As with many other large-spored species of *Alternaria*, cultures of *A. cretica* respond to scarification of surface mycelium by producing a dense turf of fresh sporulation within 1-2d.

Sporulation on PCA follows the same pattern as that on V-8, but is less abundant. Individual clumps of several conidia are borne well above the agar surface on relatively long primary conidiophores at margins of 7-10d colonies on PCA and V-8, giving an arborescent appearance to the clusters. Conidiophores on Hay are sparse and scattered, but sporulation occurs apically on all the erect hyphae (conidiophores) that are produced.

Primary conidiophores on V-8 are 60-400+ x 5-8μm, solitary or commonly arising in pairs from the same vegetative hypha, and conidiogenous at 1-3 geniculate sites in young growth. In peripheral areas of aging colonies (10+ days), solitary conidiophores are closely geniculate and apically branched with as many as 10 conidiogenous loci, yielding a terminal tight cluster of conidia. Secondary conidiophores are not found in young growth; but at 7-10 days, conversion of the apex of a conidial beak (long or short) into an enlarged conidiogenous cell occasionally is the means for production of short chains of conidia with filiform beaks.

Conidia of *A. cretica* are similar to those of *A. tomatophila* in having relatively large spore bodies and long filamentous beaks. However, conidium bodies of *A. cretica* remain narrowly ellipsoid in a large percentage of the population, whereas conidium bodies of *A. tomatophila* mostly become broad-oval or broad-ellipsoid. Additionally, colonies of *A. cretica*, like those of *A. solani* and *A. subcylindrica*, are strongly conidial under standard conditions—requiring neither mechanical manipulation nor UV-radiation treatment to induce abundant sporulation. In contrast, as noted above,

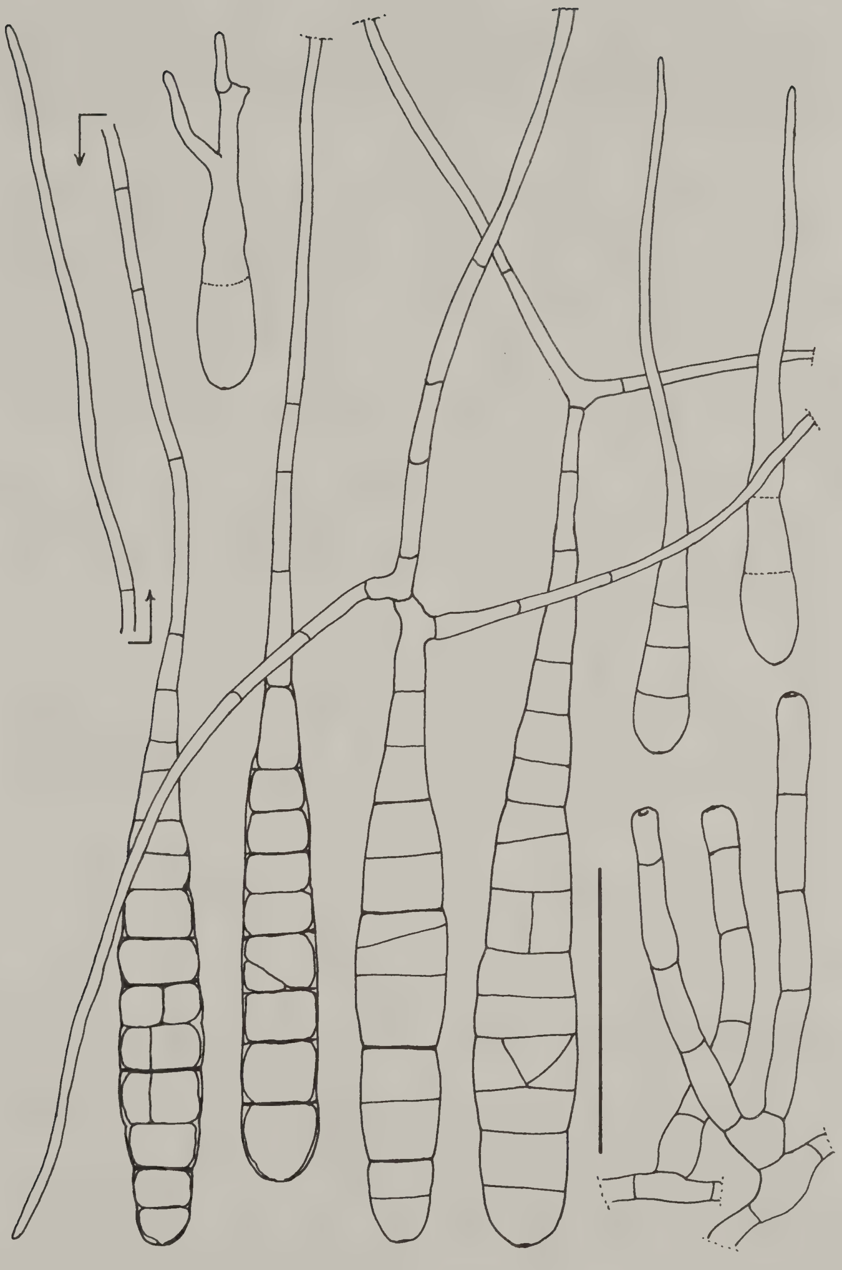

Fig. 189. *Alternaria cretica*: conidia and conidiophores ex holotype BPI 746449 (EGS 46-188) on V-8. Bar = 50μm.

all isolates of *A. tomatophila* in my hands—and as commonly reported in other studies—are poorly and tardily conidiogenous; physical manipulation of the mycelium is required for production of large numbers of conidia in *A. tomatophila* cultures.

Although a large percentage of *A. cretica* conidia mature as narrowly ellipsoid, as noted above, significant numbers—particularly those with multiple beaks—become broadly ellipsoid. One-beaked conidia tend to be narrowest and to have the longest beak: 83-110 x 14-17μm + 160-225 x ca. 2μm; two-beaked conidia, also narrow: 96-110 x 13-17μm + 128-179 x ca. 2μm; three-beaked conidia tend to have the widest spore bodies and shortest beaks on average: 96-105 x 16-26μm + 83-160 x ca.2μm. Septation ranges 8-12 transverse, with 1 longiseptum in 1-5 of the transverse segments.

Although longitudinal and oblique septa can be found readily, they are lacking in large numbers of the longest conidia. Conidium color is pale tan with septa appearing only slightly darker. Wall ornamentation is absent or only minutely punctulate.

Discussion: Three *Alternaria* taxa from tomato leaf lesions

The following list of high-range conidium measurements illustrates the hazard of proposing or relying on such static spore-size data for classification purposes unless observations on culture and sporulation patterns are factored in.

A. tomatophila	80-117 x 16-23 + 88-217 x 2μm
A. subcylindrica	84-109 x 13-18 + 122-269 x 2μm
A. cretica	83-110 x 13-26 + 134-225 x 2μm

All three of these species, grown under the same conditions, produce mature conidia whose size ranges are closely overlapping. However, using additional information:

: no known isolate of poorly sporulating *A. tomatophila* can be mistaken for heavily sporulating *A. cretica* and *A. subcylindrica*; nor are the scattered, aerial conidiophores of *A. tomatophila* (ca. 100-130μm long, mostly with solitary conidia) remarkable in comparison with the surface ones of *A. cretica* (to 400+μm, eventually with terminal clumps of as many as 10 conidia) or of *A. subcylindrica* (to 200+μm, with 1-3 conidia).

: the high proportion of narrow conidia characteristic of

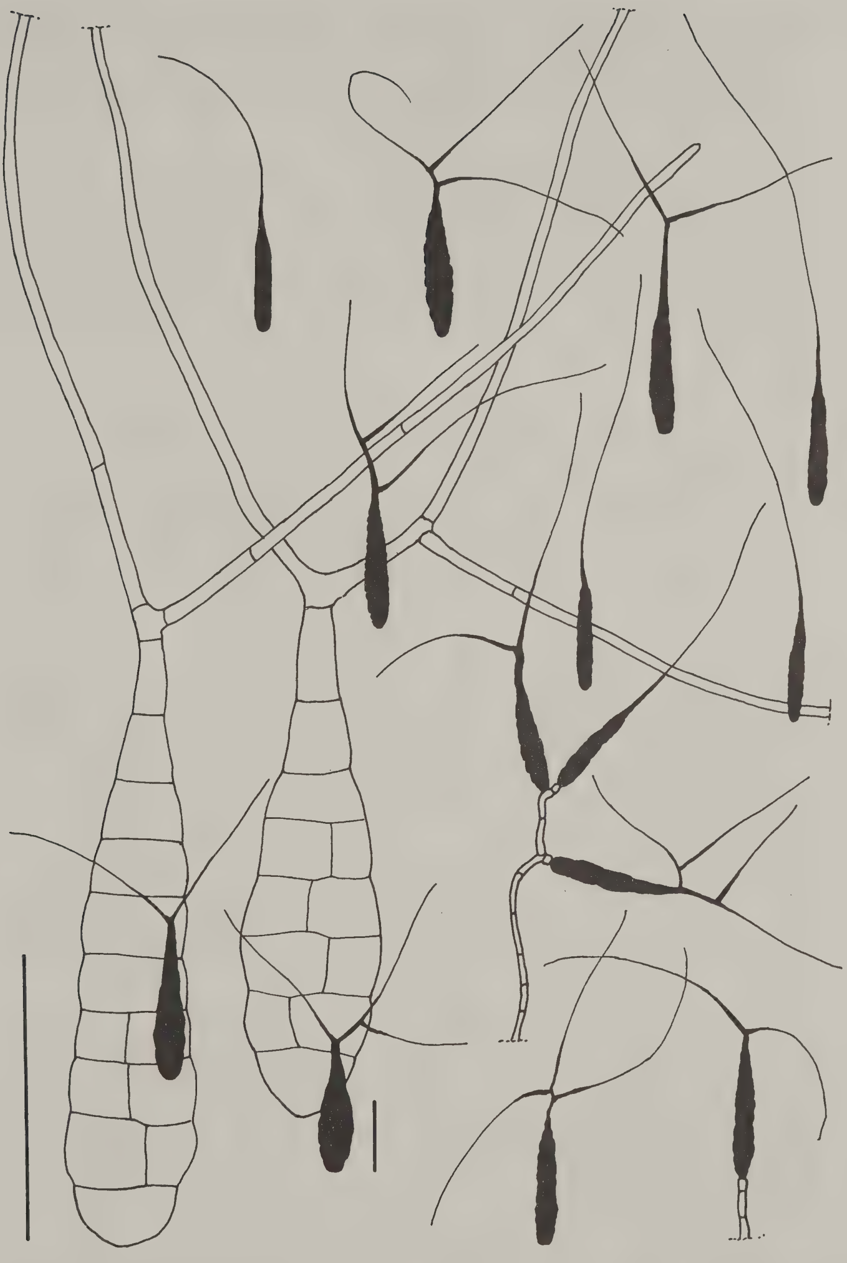

Fig. 190. *Alternaria cretica*: conidia and conidiophores ex holotype BPI 746449 (EGS 46-188) on V-8. Bar = 50μm.

the *A. subcylindrica* population is not found in *A. tomatophila*. And although the size range of the *A. cretica* conidial population includes a high percentage of narrow mature spores, it also extends to large numbers of conidia as wide as those of *A. tomatophila*.

The distinguishing features of the three taxa are striking in culture comparisons, which are as necessary to valid identifications as are their printed descriptions. This particular group of species, novel to the historical concept of *Alternaria* foliar lesions of tomato, should be an inviting subject for examination by informative molecular methods.

269-280. Miscellaneous Taxa 1883-2000

269. **Alternaria polytricha** (Cooke) Simmons, comb. nov.
≡ *Mystrosporium polytrichum* Cooke (1883), Grevillea 12: 33. Lectotype (designated here) [K]: "*Fungi.— North America, Mystrosporium polytrichum C., on Solanum melongena, No. 2816 Ravenal* [sic]"; EGS 10-166. Fig. 191

Cooke published and used the name *M. polytrichum* indiscriminately for small, obclavate phaeodictyospores occuring among somewhat effuse, velvety, dematiaceous growths on dead or senescent plant parts. The epithet *polytrichum* refers to the abundant tangled layer of erect conidiophores and sterile hyphae that forms dark colonies on most of the numerous substrates cited by Cooke for this species. The pertinent herbarium folder at K holds 19 specimens, most of them bearing the 1885 Cooke herbarium stamp and his handwriting. All of the 10[!] "syntype" substrates and Ravenel collections cited by Cooke in the type description are represented in the folder except for one on "dahlia".

Several different dark-spored hyphomycetes are present in this assemblage, including at least two different species of *Alternaria*. There is no subsequent tradition of usage for the name *M. polytrichum* in the taxonomic literature. The only major fungus exsiccatus that uses the name (Briosi and Cavara, 1892, *I Funghi Parassiti no. 191*, on gladiolus) has an *Alternaria* with conidia even smaller than those of the *M. polytrichum* lectotype.

Any one of the Ravenel collections with dictyosporic conidia in the 40-50 x 12-16µm range could serve as lectotype. I have selected material of Ravenel's no. 2816, which Cooke himself labeled and presumably examined and which has

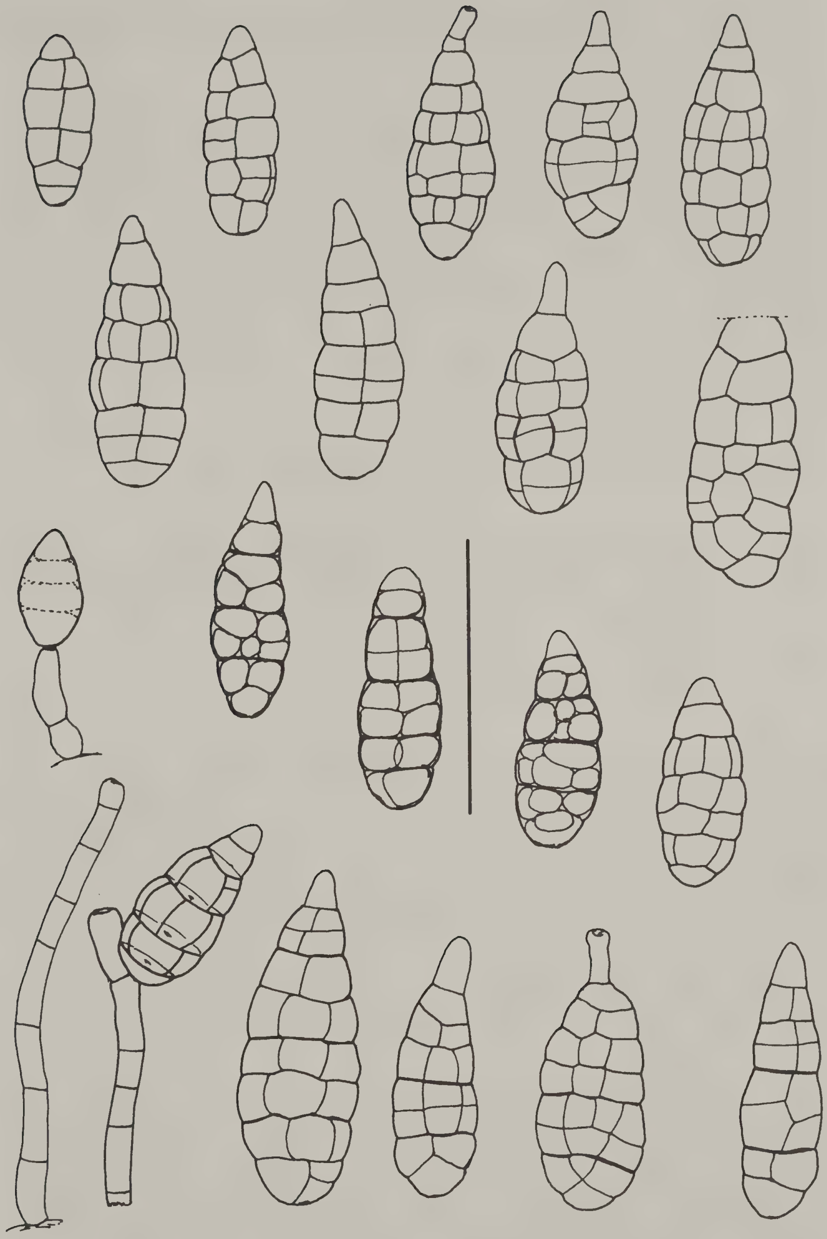

Fig. 191. *Alternaria polytricha*: conidia and conidiophores ex lectotype *Mystrosporium polytrichum* Cooke (K). Bar = 50µm.

abundant sporulation extant. This is a portion on dead stalk of eggplant, of which Cooke had received 50 units for distribution.

Cooke's concept of *Mystrosporium polytrichum* was of solitary [ob-]clavate, merenchymatic conidia, 40-50 x 12-16μm, which measurements fit a high percentage of conidia in his manuscript packet. Secondary conidiophores are rare and, when present, are only a short single cell. The ovate conidia are abundantly septate, with as many as 20-22 compartments in median-longitudinal section. Cell walls are thickened moderately but not strongly pigmented; cell lumina are pale and conspicuous within these walls. The bluntly rounded apical cell almost always is distinctly lighter walled than body cells.

270. **Alternaria longipes** (Ell. & Ev.) Mason (1928), Mycological Papers (C.M.I.), no. 2, p. 19.

≡ *Macrosporium longipes* Ellis & Everhart (1892), Journ. Mycol. 7: 134. Holotype (**NY**, Ellis Collection): "On leaves of Tobacco (Nicotiana Tabacum). Raleigh, N.C. Oct. 91. Prof. Gerald McCarthy." EGS 03-094.

≡ *Alternaria longipes* (Ell. & Ev.) Tisdale & Wadkins (1931), Phytopathology 21: 652.

The history of the homonymy of *A. longipes* (Mason 1928, Tisdale and Wadkins 1931) and attendant confusion about the identity of the taxon no longer present problems. Mason incorrectly attributed the name to a filament-beaked "*A. solani* type" isolate that he had studied from Rhodesian tobacco. Although he did not have the fungus described by Ellis and Everhart, and soon realized the error, the priority of his new name combination was established. The research reported by Tisdale and Wadkins was with the original pathogen and remains pertinent, even though their new name combination became a later homonym. See *Alt.T&V* 6 (Simmons 1981).

The type specimen and modern specimens and isolates of *A. longipes* have been considered in detail in earlier papers of this *Alt.T&V* series. The first treatment was in a paper on species whose conidia have no true beak, only secondary conidiophores in chain formation (*Alt.T&V* 6; Simmons 1981). A more recent paper defined the taxon in terms of sporulation patterns and conidium morphology under controlled conditions of axenic culture (*Alt.T&V* 241; Simmons 1999). In the latter paper *A. longipes* was distinguished from *A. alternata* and from the several members of a heterospecific "*A. alternata* pathotype" usage maintained for ill-considered reasons in the literature on host-specific toxin producers.

Publications on aspects of brownspot of tobacco have issued from several research laboratories in North Carolina. Since 1971 (Lucas), most of the papers have treated *A. longipes* as a synonym of *A. alternata*, in the erroneous belief that the two taxa are morphologically indistinguishable. For discussion of points of unique identity for *A. longipes*, its specific pathogenicity, and comparable illustrations, see *Alt.T&V* 6 and 241, as cited above. Support of my two-species morphotaxonomic conclusion is accumulating in other recent studies that include, and strongly differentiate, the two taxa. These reports are based on secondary metabolite data (Andersen and Roberts 1999) and on molecular (RAPD) analyses (Peever et al. 1999; Roberts et al. 2000).

271. **Alternaria tabacina** (Ell. & Ev.) S. Hori (1903), Nōsaku-butsu Byōgaku, p. 276. Fig. 192

≡ *Macrosporium tabacinum* Ellis & Everhart (1892), Journ. Mycol. 7: 134. Holotype [NY]: "*On leaves of tobacco (Nicotiana Tabacum), Raleigh, N.C. Oct. 1891, Prof. Gerald McCarthy*"; EGS 04-132.
≡ *Alternaria tabacina* (Ell. & Ev.) Gulyás (1930), Kisérl. Közlem. 33: 300.

Ellis and Everhart described an *Alternaria* present on tobacco leaf spots known as "white speck" among planters. Whatever the cause of the small paper-white lesions, it is found that conidia of several different fungus genera are on the spots—*Epicoccum*, *Cladosporium*, *Phyllosticta*, and two species of *Alternaria*, one with very small spores and a second one with conidia of medium size with an attenuate beak and apical secondary conidiophore.

The type description is of conidia 15-25 x 10-12μm (3-septate) or a longer 35-45μm with a narrowed end 8-12μm long. It seems likely, then, that the authors missed or ignored the distinctive small-spored taxon (beakless conidia ca. 13-19 x 6-7μm) and focused on the larger conidia with their long-narrow, but not filamentous, beaks. Beaked conidia from the type are found as up to ca. 75-80 x 14-19μm, with the spore body itself ca. 35-45μm long. The narrow, septate beak often terminates in a short conidiogenous swelling, which characterizes the species as chain-forming. Some conidia fail to produce a beak and, instead, become conidiogenous through a minor swelling at the spore-body apex. Conidium septation is up to 7-8 transverse and 1-2 longitudinal in many of the transverse segments.

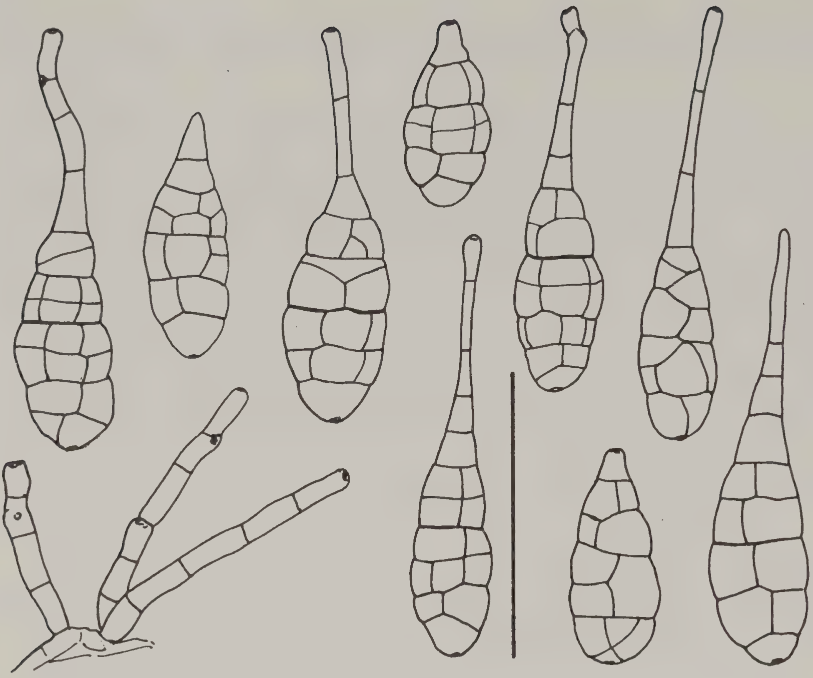

Fig. 192. *Alternaria tabacina*: conidia and conidiophores ex holotype of *Macrosporium tabacinum* Ellis & Everhart (NY). Bar = 50μm.

As a field collection, the type of *A. tabacina* cannot be distinguished from great numbers of fungus growths on innumerable plant-genus substrates. The taxon is one that routinely would be placed in an "*A. tenuissima* species-group," whose sporulatiion and morphology in culture seldom can be predicted from a few field conidia.

The meager literature that mentions *A. tabacina* does not demonstrate convincingly a pathogenic relationship with tobacco lesions. Nor is *Pleospora nicotianae* Averna-Saccá (1922) convincingly established as the "perfect stage" of *A. tabacina* simply because two fungi, so identified by Averna-Saccá, were observed on the same old tobacco stalk.

Hori's transfer of *Macrosporium tabacinum* into *Alternaria* dates from 1903 (sometimes cited incorrectly as 1908 from a secondary source, Kawakami and Suzuki). Hori used "*Alternaria Tabacina*, (Ell. et Ev.) S. Hori" in his discussion. This reference to "Ell et Ev." without citation of basionym or previous literature is acceptable in valid publication of his new combination in 1903, although it would not meet present-day criteria of validity (Greuter et al. 1994; ICBN 32.4, 32.5, 33.2 on full and direct references after 1953). The 1930 combination proposed by Gulyás ranks only as a later homonym.

272. **Macrosporium esculentum** Ellis & Everhart (1894), Proc. Acad. Sci. Philadelphia (45(1893): 464. Lectotype (designated here) [**NY**]: "*on eggplant (dried up)* [fruit], *Newfield, N.J. March 13. 1893*. [Ellis Collection] *3602a*"; EGS 03-046. Fig. 193

Two packets with similar labels and what appear to be portions of a single collection are in the Ellis Collection at **NY**. The lectotype label bears a number, 3602a. The second packet bears no number and did not yield fungus material useful in identification of *M. esculentum*. The eggplant substrate bears conidia of two readily distinguishable taxa of *Stemphylium*.

The authors' type description is of conidia that are subglobose (8-15μm diam.), to oblong-elliptical (12-22 x 10-15μm), to obovate (10-15 x 7-12μm). The subglobose conidia found in the type have two septa intersecting at right angles; other conidia have three major transepta plus secondary septa at various angles, yielding a muriform pattern. Largest conidia found on reexamination of the type specimen and which match the type description are ca. 20-22 x 17-22μm in side view; subglobose spores with cruciate septation, which usually are young conidia seen in end view, are ca. 11-13μm diam.

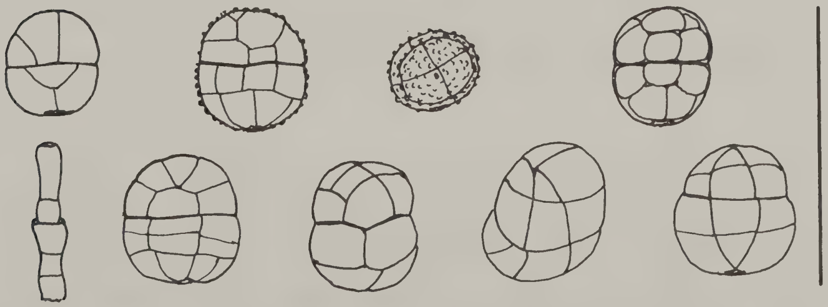

Fig. 193. *Macrosporium esculentum*: conidia and conidiophore ex lectotype (**NY**). Bar = 50μm.

Macrosporium esculentum is a typical species of *Stemphylium*. Since the culture-based classification literature on *Stemphylium* taxa still is far from comprehensive, it would be imprudent to assign a name to this field specimen. Its closest morphological resemblance, based on conidia only, is to *S. globuliferum* (Vestergren) Simmons (1969).

The second, distinctly different taxon of *Stemphylium* present on the Ellis specimen has conidia that are comparatively large, broadly ovate or roughly rectangular in outline, 30-40 x 18-23µm, with 4-5 transverse septa and 1-3 longitudinal or oblique septa in the transverse segments. This second taxon is not involved in the typification of *M. esculentum*; it is morphologically similar to *S. herbarum* Simmons (1985).

273. **Macrosporium brassicae** Berk. f. **solani** Fautrey & Brunaud, in Lambotte and Fautrey (1894), Revue Mycol. 16: 76. Lectotype remains undesignated: "*Sur les feuilles de Solanum nigrum. Rec. cl. Paul Brunaud. F. Fautrey.*"

Brunaud's specimen supplied material for Roumeguère's *Fungi selecti exsiccati* no. 6559 and apparently for at least one Fautrey manuscript portion now at **UPS**. Three portions (**NY**, **NY**, **UPS**; EGS 04-165, 04-166, 11-068) yielded the broken base of one (!) large conidium reminiscent of *A. solani*. The "forma" was published as having conidia up to "110, 115, 116µm" long, with 7-9 transepta and 1-2 longisepta. The handwritten label on the specimen at **UPS** bears much the same information as that of the type description, except that the largest conidia are indicated to be 90 x 17µm.

The broken conidium almost certainly is of an *Alternaria*. Presumably an identifiable fungus could be discovered by searching out other copies of the Roumeguère distribution; someone other than me must do the searching. The chance that this "forma" has to do with *A. (M.) brassicae* is minimal.

274. **Alternaria brassicae** (Berk.) Sacc. var. **tabaci** Preissecker (1916), Fachl. Mitteil. Österr. Tabakregie 16: 13. Lectotype (designated here): illustration, l.c., Taf. III, figs 17-52; Taf. IV, figs. 53-83.

No specimen has been found that can serve as type of the name introduced by Preissecker for fungi studied in Rumania and, as he reported (l.c.), on tobacco from Hungary, Galicia, Dalmatia, Serbia, and Macedonia.

The fungus is not identifiable as a unique taxon—variety or otherwise—on the basis of the illustrations and extensive description. Certainly it has no resemblance to large-spored *A. brassicae*.

Preissecker described conidia as solitary or rarely in chains of 2-3, becoming 30-107 x 7-16μm, but mostly 50-70 x 10-15μm, with 3-11 transepta and an occasional longitudinal or oblique septum in several of the transverse segments. Conidia were described as having a long beak which, however, is not a prominent feature of the illustrations.

The Preissecker material, as presented, can be neither *A. longipes* nor *A. tabacina*, both of which have conidia smaller in general than those of *A. brassicae* var. *tabaci*. The "long beak" of the latter actually was illustrated as merely an apical narrowing that usually is considerably shorter than the spore body. Joly (1964) considered the variety name to be a synonym of *A. tenuissima* (Nees) Wiltshire.

Alternaria brassicae var. *tabaci*, in the absence of a specimen, cannot now be identified more closely than as one among large numbers of *Alternaria* taxa with medium-size conidia on leaf lesions.

275. **Alternaria capsici-annui** Săvulescu & Sandu-Ville (1934), in T. Săvulescu, Herb. Myco. Roman. no. 658. Lectotype (designated here) [**NY**]: "*In pericarpio Capsici annui culti...Mentenia, distr. Ilfov—București—1/VII/1932*"; EGS 03-078. Fig. 194

Lesions of *Capsicum annuum* fruits, like those on fruits of other solanaceous plants, may support lush sporulation of several different *Alternaria* taxa. Representatives of sporulation groups that include *A. alternata, A. tenuissima*, and *A. arborescens* are frequent; usually they cannot be identified more closely than to group unless they are obtained in culture.

Conidia of typical *A. capsici-annui*, not yet known in culture, are readily distinguishable from those of the more common small-spored groups mentioned above; they do not resemble those of the large-spored, filiform-beaked taxa of the *A. solani* group. Young conidia are ovoid, sometimes with a blunt-wedge apex, but without a definable beak. As the spore body lengthens, it gradually tapers upward to yield narrow-ellipsoid or obclavate conidia in an intermediate size range up to ca. 80-100 x 12-16μm. The blunt beak sometimes converts apically into a short, 1-celled secondary conidiophore. Largest conidia have up to 10-13 transepta and 1-2 longisepta in several segments of the spore body. The secondary conidiophore of many conidia is evidence of chain formation, but potential chain length cannot be predicted from this field material.

Alternaria capsici-annui calls to mind a few other species whose largest conidia are relatively long and narrow with abundant transepta and a sturdy beak taper. Reference is to *A. triticicola* V. G. Rao (1964; and cfr. *Alt.T&V* 111, Simmons 1994) and *A. putrefaciens* (Fuckel) Simmons (*Alt.T&V* 144, Simmons 1995).

276. **Alternaria melongenae** Rangaswami & Sambandam (1961), Mycologia 52(1960): 519. Lectotype (designated here): Mycologia 52: Fig. 3, p. 518. 1961. The type collection was said to be "On living leaves of *Solanum melongena L.*, Annamalainagar in Madras State, December 1958, *C. N. Sambandam*, TYPE in Herbarium of the Department of Agriculture, Annamalai University, Annamalainagar, Madras, and in Herb. Crypt. India Orient (HCIO), New Delhi (Accession No. 26,663)."

The name "*A. melongenae* Rang. & Samb." first appeared without description or illustration in Rangaswami and Sambandam (1960), i.e., as a nomen nudum. Associated information (l.c., p. 486) was: "A report of leafspot and fruit scab of eggplant (*Solanum melongena* L.) and fruit rot of chili (red) pepper (*Capsicum annuum* L.) caused by a new species of *Alternaria*—*A. melongenae* Rang. & Samb.—is being published elsewhere."

The name dates from valid publication in 1961, as indicated above. Application for permission to examine the type material at Annamalai University elicited a non-type collection dated October 1960. The Dec. 1958 type portion seen at New Delhi, HCIO-26663 (EGS 29-125), consisted of four leaves with small scattered spots; no *Alternaria* conidia were found among the insect debris on the spots. Since the type of a fungus name is a fungus, not barren leaf spots, the name is lectotypified here by the authors' published illustration, as cited above (Greuter et al. 1994; ICBN Art. 8.3).

The fungus was described as having fasciculate, geniculate conidiophores 65-91 x 5-7μm and conidia in straight chains of 2-5, brown, obclavate, smooth, 28-84 x 7-17.5μm, with 4-7 transepta and 0-5 longisepta and light brown beaks 10.5-52.5μm long. Neither the description nor the type

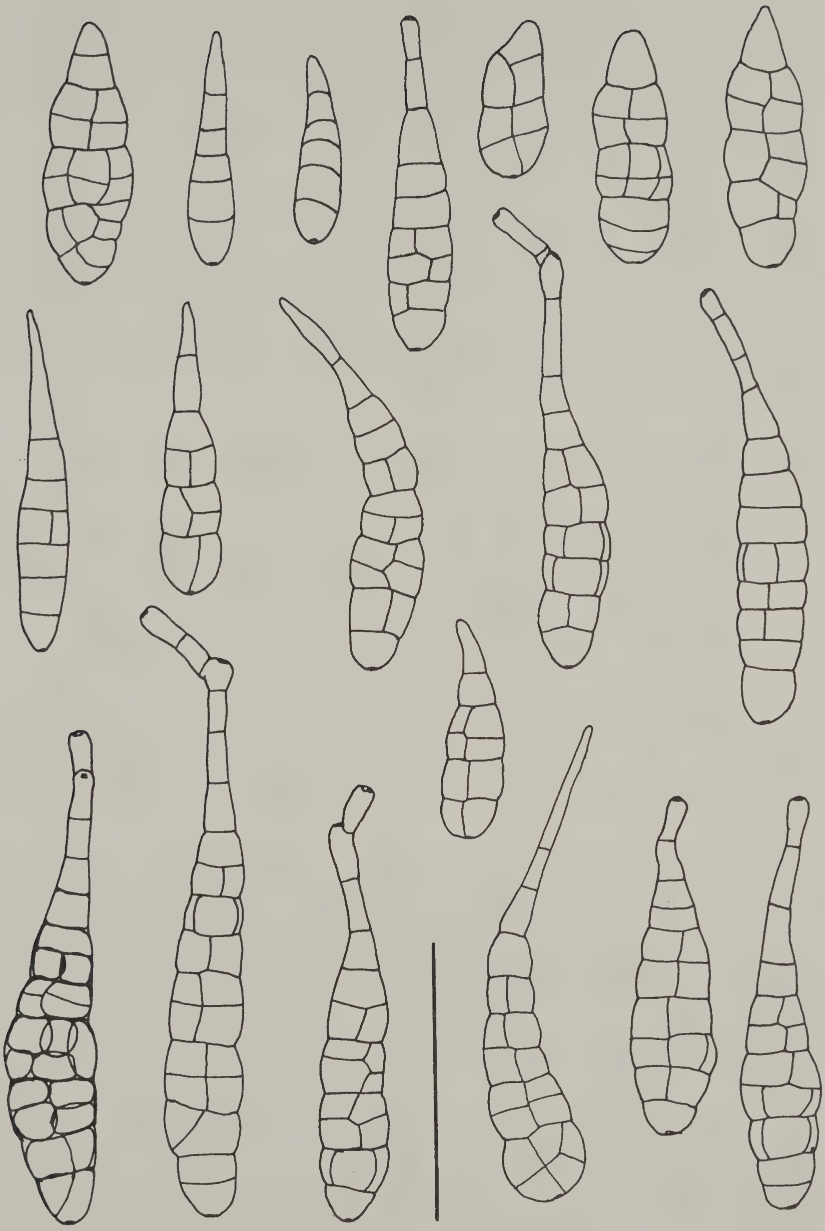

Fig. 194. *Alternaria capsici-annui*: conidia ex lectotype (NY). Bar = 50μm.

illustration yields information sufficient to distinguish *A. melongenae* from large numbers of similar small-spored *Alternaria* taxa. The possibility that conidium beaks as long as 52.5µm might be a distinctive character fades when the type illustration shows a few apical extensions that obviously are pseudorostrate secondary conidiophores.

Isolates identified as this species were discussed in great detail by the authors in their initial paper (1960), but no major culture collection lists them as having been accessioned. There is no point in trying to classify *A. melongenae* as distinguishable among small-spored *Alternaria* species when neither a morphologic type nor derivative cultures are extant. The taxon is unidentifiable on the basis of available information.

277. **Nimbya major** (Pavgi & Singh) Simmons, comb. nov.
Fig. 195

≡ *Alternaria longipes* (Ell. & Ev.) Mason var. *major* Pavgi & Singh, Mycopath. Mycol. Appl 30: 262. 1966. Lectotype (designated here) [**IMI** 106237]: "[host] *Nicotiana plumbaginifolia* Vir., Deoria, India, U. P. Singh, IV [M.S.P. 325, 14 August 1963]"; EGS 23-161.

Pavgi and Singh designated their specimen as "TYPE (MSP no. 325) (IMI 106237)." I have examined the IMI holding, hence the lectotype designation above. The abundant conidia and conidiophores of this specimen represent a unique taxon of *Nimbya* Simmons (1989).

The authors of the variety name described a fungus occurring on leaf spots 5-15mm. diam.: conidiophores brown, erect and simple or in groups of 2-3, branched, geniculate, 3-7 septate, 32-85 x 3.5-5µm; conidia ochraceous brown, muriform, minutely rough-walled, long-beaked, 2-10 septate, catenulate, 37.5-120 x 5-10µm. The original description holds up well on reexamination of the type, except that ornamentation of conidium walls is not now apparent.

The long beak of the relatively narrow conidia of *N. major* sometimes is a true beak—a gradually narrowed but not filiform apical extension of the spore body. Similar bristle-like beaks are present in *N. scirpicola* (Fuckel) Simmons and *N. gomphrenae* (Togashi) Simmons (1989). Equally commonly, the conidium apex, instead of narrowing, extends into a sturdy secondary conidiophore with a distinct apical hilum and conidiogenous pore.

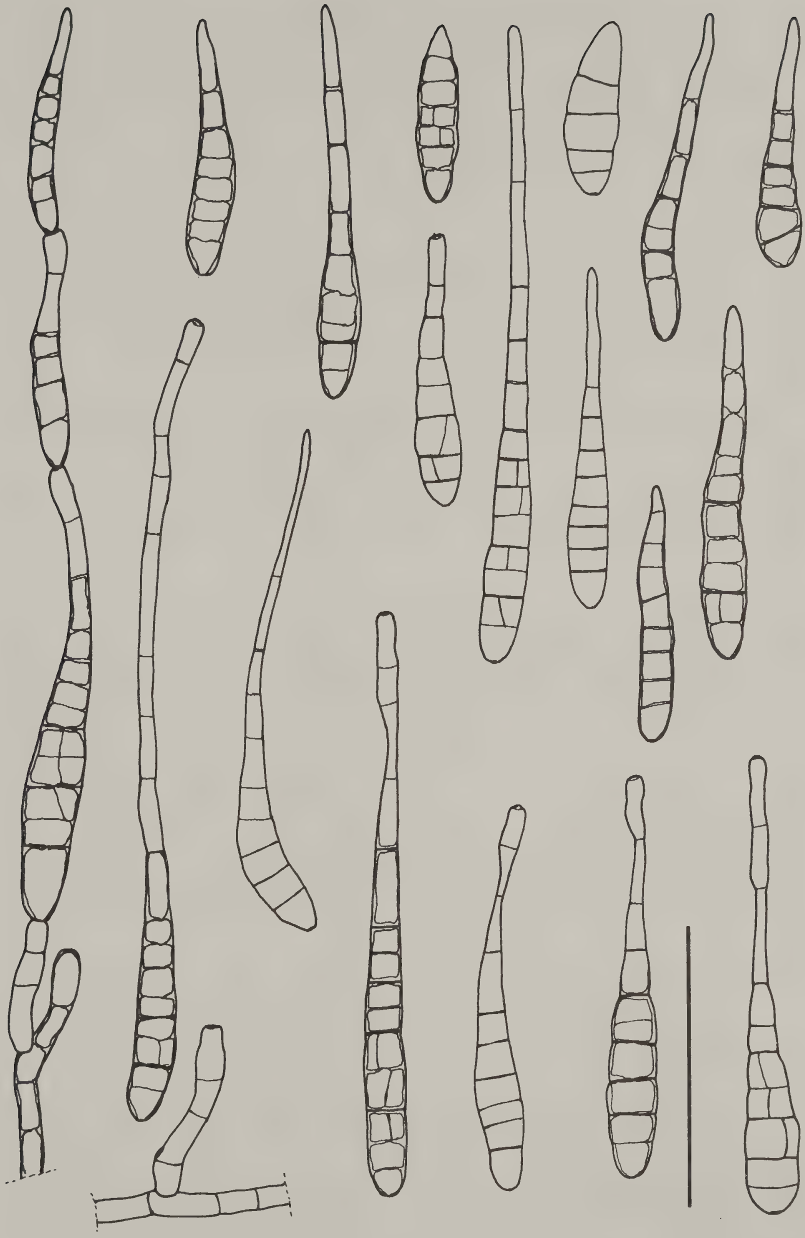

Fig. 195. *Nimbya major*: conidia and conidiophores ex lectotype of *A. longipes* var. *major* (IMI 106237). Bar = 50μm.

Conidia with a true tapering beak are up to 60-90 x 7-10µm; conidia bearing a major secondary conidiophore may be as long as 150µm. Conidia are strikingly distoseptate; a transverse euseptum is inserted through the distoseptum matrix between a few adjacent cells. Conidium bodies have as many as 8-10 transverse distosepta and sometimes have one longiseptum in 1-2 of the cells.

278. **Alternaria elaeagni** Vidhyasekaran, Ranganathan & Rangaswami (1973), Current Sci. 42: 804. Holotype [**MH**]: reported as "*on leaves of Solanum elaeagnifolium Cav., Palladam Taluk, Coimbatore District, Tamil Nadu, India, coll. G. Rangaswami no. 233, 15 April 1973*".

I have not been able to establish contact with either the herbarium of Tamil Nadu Agricultural University [**MH**] or the authors of *A. elaeagni*. The type illustration and description of small, short-beaked conidia are not sufficient for identification of the taxon within the context of other small-spored species.

279. **Alternaria mimicula** Simmons (1995), Mycotaxon 55: 129. Holotype [**BPI** 803024]: a dried culture of an isolate from a tomato transplant, Georgia, U.S.A., before 1950; EGS 01-056.

The ex-type culture of *A. mimicula* was discussed in detail in *Alt.T&V* 134 (Simmons 1995). The sporulation pattern and conidia of the species mimic those of *A. brassicicola* (Schw.) Wiltshire (1947) but on a smaller scale overall. For the original description, discussion, and comparable illustrations of *A. mimicula*, see *Alt.T&V* 134.

280. **Alternaria arborescens** Simmons (1999), Mycotaxon 70: 356. Holotype [**BPI** 749422]: a dried culture of an isolate (AS27-3pz) from stem canker of *Lycopersicon esculentum*, California, U.S.A.; EGS 39-128.

The ex-type culture of *A. arborescens* was discussed in detail in *Alt.T&V* 243 (Simmons 1999). This tomato-stem pathogen is especially important in the classification of small-spored *Alternaria* species in that it is the first named representative of a frequently encountered "arborescent" sporulation pattern (Simmons and Roberts 1993).

The morphology of an extraordinarily long primary conidiophore with major sporulation branches near its apex is readily detected in cultures at 50X. Because of the fragility of *Alternaria* sporulation structures in dried field specimens, I have not been successful in identifying the arborescent pattern in type specimens of earlier material.

This sporulation type was very abundant among isolates from Japanese pear lesions in a study of material from Japan, Taiwan, and U.S.A. (California and Maryland) (Simmons and Roberts 1993). It now comes to our attention as isolates from many substrates, e.g., cherry fruit, barley kernels, potato leaves, asparagus branchlets.

For the original description, discussion, and comparable illustrations of *A. arborescens*, see *Alt.T&V* 243. There is considerable literature on this species, most of it under a form-species epithet *A. alternata* f. sp. *lycopersici*, which has no priority standing in formal nomenclature (Greuter et al. 1994; ICBN Art. 4.N.3).

281-285. Additional Novel Taxa of Alternaria

Generous mycology and phytopathology colleagues have provided me with many isolates or isolatable material of *Alternaria* from solanaceous substrates as well as supporting information and observations. Among these, numerous examples of *A. solani* from potato and *A. tomatophila* from tomato have furnished abundant evidence that the two species are readily distinguishable, despite nearly 100 years of confusion about their identities.

Other specimens from widely separated geographic sources support my *Introduction* prediction that we are far from having a comprehensive picture of the diversity to be found among *Alternaria* taxa on solanaceous hosts. The host family is large, with an estimated 2000 species. No concerted effort ever has been made to search a wide range of its wild members for *Alternaria*.

Notable among an accumulation of novel species for which excellent isolates have been available are *A. subcylindrica* Simmons & R. Roberts (*Alt.T&V* 267) and *A. cretica* Simmons & Vakalounakis (*Alt.T&V* 268) as well as:

: 281. *Alternaria capsici* Simmons; ex *Capsicum annuum*, Australia

: 282. *Alternaria cyphomandrae* Simmons; ex *Cyphomandra betacea*, New Zealand

: 283. *Alternaria elegans* Simmons & J. David; ex *Lycopersicon esculentum*, Burkina Faso

: 284. *Alternaria nitrimali* Simmons & M. E. Palm; ex *Solanum viarum*, Puerto Rico

: 285. *Alternaria grandis* Simmons; ex *Solanum tuberosum*, Pennsylvania, U.S.A.

* * * * *

281. **Alternaria capsici** Simmons, sp. nov. Fig. 196

Etym.: L., *Capsicum (annuum)*, type substrate.

*Ex cultura in agaro V-8 descripta. Sporulatio dispersa, sed in colonia margine fasciculis conidiorum 6-10. Conidiophora primaria 35-130 x 8µm, interdum ramosa et 2-3 conidiogena; conidiophora secondaria 30-100 x 8µm. Conidia erostrata anguste vel late ellipsoidea, ca. 45-75 x 12-18µm, 4-7 transverse, 1-2 longitudine septata; conidia rostrata ad 77-109 x 16-19µm (corpus), 190-280 x 7⟶3µm (rostrum); longitudo tota vulgo 300-375µm. Conidia obscure dilute brunnea, laevia, 7-9 transverse et longitudine nulla vel 1-3 septata. Habitatio typi Capsicum annuum L., Australia. Typus: partes ex cultura EGS 45-075 (ex **IMI** 262408) desiccatae et in **BPI** 746450 (holotypus) et saltem in **IMI** (isotypus) conservandae.*

The 7-day V-8 colony is densely woolly in the center, becoming an open growth of long aerial hyphae near the margin. Development is marked by successive daily concentric rings corresponding to the daily light/dark cycle. Sporulation occurs at the agar surface and scattered among the woolly mycelium. At the more open periphery of the colony, surface sporulation is of abundant clusters of 6-10 solitary and short-catenate conidia.

Sporulation on PCA follows the same pattern as that on V-8 but is less abundant. Conidium production on Hay agar is excellent though uncrowded, with very little aerial mycelium; chain formation is dominant and striking on Hay, with as many as 3-5 conidia with long filiform beaks per chain.

A sample of the conidium population contains a high percentage of relatively large conidia with a long narrow beak, large numbers of totally erostrate conidia, and conspicuous examples of large conidium bodies with a strong apical secondary conidiophore. The pattern of conidium development is easy to deduce: most conidia lack a beak

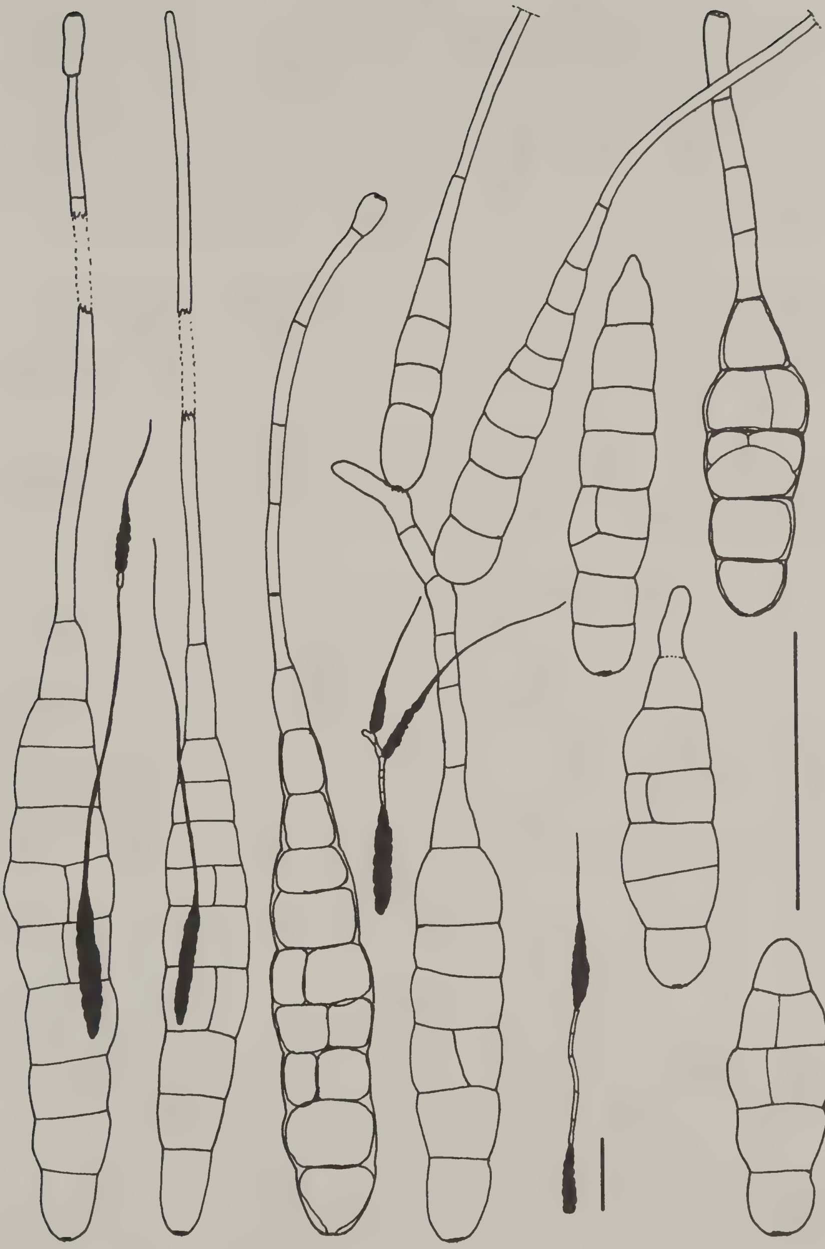

Fig. 196. *Alternaria capsici*: conidia ex holotype **BPI** 746450 (EGS 45-075) on V-8. Bar = 50μm.

structure until they are 45-75µm long, at which point each initiates either a true beak, which is narrow (ca. 3µm wide) and may become very long, or a broader (4-5µm) secondary conidiophore directly from the apical cell of the conidium. Quite often the elongation of a filiform beak is terminated abruptly by production of a wider cell (ca. 6 x 4µm), which functions as a secondary conidiophore in chain production. The filiform beak may be only ca. 35µm long, or as long as 225µm when production of a secondary conidiophore occurs.

Usually there are only two conidia in a chain (3-5 on Hay). Numerous small clumps of 3-4 conidia develop when a secondary conidiophore becomes geniculate and conidiogenous at 2-3 loci; these clumps often contain as many as 10 conidia as the colony margin ages.

Primary conidiophores are 35-130 x 8µm and sometimes are branched and conidiogenous at 2-3 sites. Secondary conidiophores that arise directly from the apical cell of a conidium commonly are 30-100 x 8µm.

Erostrate conidia are narrow- or broad-ellipsoid, ca. 45-75 x 12-18µm, and have 4-7 transverse septa plus 1 longiseptum in 1-2 transverse segments. The spore bodies of rostrate conidia reach sizes of 77-109 x 16-19µm; the base of the filamentous beak is ca. 7µm broad but it narrows quickly, with beaks becoming 190-280 x 3µm. Total conidium lengths of 300-375µm are commonly found. Conidia are a pale dull tan, smooth, and have 7-9 transepta and no longitudinal septa or often 1 longiseptum in 1-3 of the transverse segments. Some primary transepta are somewhat constricting and slightly darker than the pale secondary septa.

282. **Alternaria cyphomandrae** Simmons, sp. nov Fig. 197

Etym.: L., *Cyphomandra (betacea)*, type substrate

Ex cultura in agaro V-8 descripta. Sporulatio in colonia centrali dispersa, margine abundiore in fasciculis unusquisque constanti ex conidio primario longirostrato et aliquot conidiis secondariis ex ramulis conidiogenis rostri primarii. Conidiophora primaria ca. 80-150 x 8µm, simplicia vel interdum 1-2 geniculata et conidiogena. Conidia longe angustiobclavata vel ellipsoidea, rostro singulo insigniter longo; ad 90-115 x 16-19µm (corpus), 147-230 x 6.5-8⟶3µm, obscure dilute brunnea, laevia vel punctata, 6-12 transverse, raro longitudinaliter distoseptata, tarde euseptata. Habitatio typi in laesionibus fructuum Cyphomandra betacea (Cav.) Sendtn., New Plymouth, New Zealand, v.1991. Typus: partes ex cultura EGS 40-058 (ex Lynfield Plant Protection Centre,

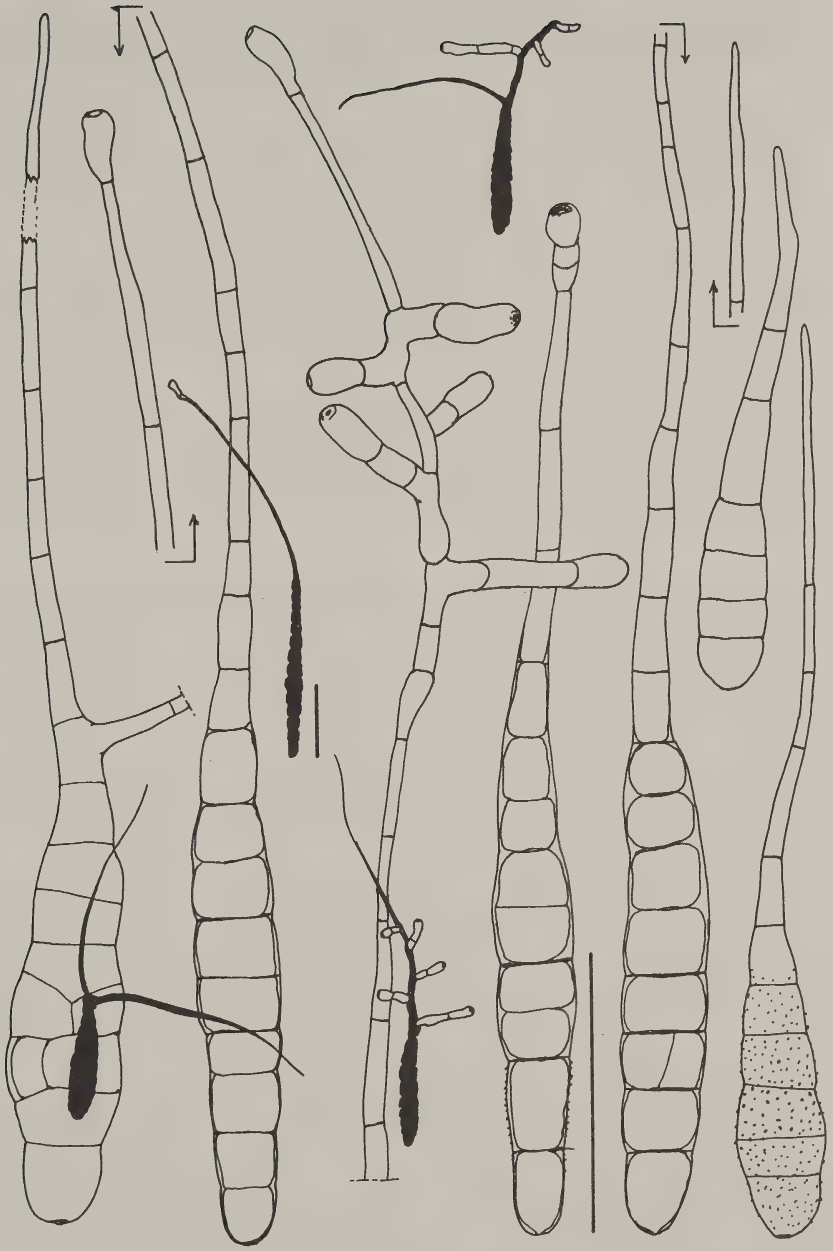

Fig. 197. *Alternaria cyphomandrae*: conidia and conidiophores ex holotype **BPI** 746451 (EGS 40-058) on V-8. Bars = 50μm.

*Auckland, New Zealand, no. 6414.1) desiccatae et in **BPI** 746451 (holotypus) et saltem in **IMI** (isotypus) conservandae.*

The 7-day V-8 colony has a moderately woolly texture in the center but is almost lacking of non-sporulating mycelium in outer areas of growth. Development shows successive daily concentric rings of sporulation. Sporulation is scattered and only moderate in the colony center, but it becomes progressively more abundant in the outer half of the colony. Sporulation is predominantly in crowded clusters of conidia; each cluster comprises a primary long-beaked conidium and several secondary conidia that arise from conidiogenous branches of the primary beak.

Sporulation on PCA develops in the same pattern as does that on V-8, but is less abundant. Conidium production on Hay is uncrowded but very good; there is practically no aerial mycelium within the colony. Conidia on Hay are solitary or in small clusters formed in the same pattern as that seen on V-8.

Primary conidiophores, whether produced directly from the agar surface or as terminal dark swollen cells of an aerial hypha, are ca. 80-150 x 8μm; they may be simple or 1-2 geniculate and conidiogenous. Production of secondary conidiophores occurs either as a swollen tip cell of a filiform beak or occasionally as a striking array of lateral branches directly from the beak itself. These very unusual lateral conidiophores are ca. 7-50 x 7-8μm; they are sources of many of the typical clusters of conidia found in V-8 sporulation but which are more plentiful in PCA populations.

The spore population is dominated (ca. 98%) by long, narrow-obclavate or ellipsoid conidia with a single very long beak, which narrows perceptibly from a relatively broad base to a filiform apex. Spore bodies of single-beak conidia reach 90-115 x 16-19μm, plus beaks 147-230 x 6.5-8.0⟶3μm; they are dull pale brown, smooth to scattered or closely punctulate, or scattered punctate. Conidia are distoseptate, with tardy insertion of eusepta. Transverse eusepta and the uncommon longitudinal septa are pale and inconspicuous. Although the distoseptum matrix remains obvious in mature conidia of *A. cyphomandrae*, the cell locules remain well rounded (in lactic acid mounts) and do not present the multiangular appearance found in species of *Nimbya*.

Minor numbers of *A. cyphomandrae* conidia are 2-beaked, with the spore body up to 83-93 x 17.5-20μm, plus a primary beak 112-192 x 5.5⟶2.5μm and a secondary beak 115-205 x 4-5⟶2.5μm. Two-beaked conidia thus tend to be shorter than the largest one-beaked conidia and to have correspondingly fewer transepta (8-9), with a very uncommon 1 longiseptum in 1-3 of the transverse segments.

283. **Alternaria elegans** Simmons & J. David, sp. nov.

Fig. 198-199

Etym.: L., *elegans*, elegant, delicate

Ex cultura in agaro V-8 descripta. Hyphae paginae aeriaeque coloniae ad 1 cm. longae, intertexta, semper conidiogenae, ramosa ut pote conidiophora brevia primaria. Sporulatio in colonia centrali aggregata, alibi conidia manifeste solitaria, catenis 2-5, vel parvicaespitulis. Conidiophora primaria solitaria, interdum ramosa vel geniculata, ca. 8-35 x 3-4µm. Conidia cylindrica, anguste ovoidea vel ellipsoidea, vulgo erostrata sed etiam longifilamentose rostrata, dilute vel moderate brunnea, laevia vel inconspicue punctulata. Conidia erostrata ad 38-50 x 9.5-13.5µm, 5-7 transverse septata, 1-2 longiseptata in 1-3 segmentis transversis; conidia rostrata ad 36-53 x 10-12µm (corpus), 82-205 x 2µm (rostrum). Habitatio typi semenibus Lycopersicon esculentum Mill., Burkina Faso. Typus: partes ex cultura EGS 45-072 (ex **IMI** *374542) desiccatae et in* **BPI** *746452 (holotypus) et saltem in* **IMI** *(isotypus) conservandae.*

The type of *A. elegans* is based on an isolate from a tomato seed lot examined in Burkina Faso, which was received for discussion via **IMI** 374542. The question of possible pathogenicity of the taxon remains moot, but the question of its identity does not. An initial hope that the isolate might be a living representative of the elusive *A. tomato* proved unsustainable. Differences between small-spored, filament-beaked *A. elegans* and *A. tomato* are strong, even though observations to date have been based only on controlled living cultures of *A. elegans* in comparison with dried herbarium material of *A. tomato* (see *Alt.T&V* 255).

The 7-day V-8 colony is an open thicket of long, interlaced hyphae, including moderate amounts of arachnoid or byssoid aerial mycelium; all hyphae—surface or aerial—are conidiogenous. The relatively small conidia are solitary, or in short chains of 2-5 units, or in small clusters. They are produced in large numbers throughout the colony, but appear as crowded masses of sporulation only in the early surface growth of a colony.

Sporulation on PCA is even more abundant than on V-8, with much of the conidium production occurring on loosely intertwined aerial hyphae or as chains of several conidia with long filamentous beaks. Sporulation on Hay is very abundant, though less so than on V-8 and PCA, and has the same pattern of production as solitary units, small clusters, and short chains.

Primary conidiophores of *A. elegans* on V-8 occur typically as short branches of the open network of long surface and aerial hyphae; the conspicuous procumbent or arching conidiophore-bearing hyphae commonly are ca. 1 cm. long; the conidiophore branches themselves are solitary, sometimes branched or apically geniculate and conidiogenous, and ca. 8-35 x 3-4μm.

The Latin typification description above is from V-8 culture, in order to keep characterization of *A. elegans* consistent with those of other species treated here. However, conidium characters are summarized and illustrated for the three media used—PCA, Hay, V-8—since the expression of some conidium characters changes markedly with the medium. Although some species-diagnostic characters are present in all populations, the 7-day V-8 population is dominated by conidia that remain erostrate; the 7-day PCA by conidia with extremely long filiform beaks; and the 7-day Hay by conidia whose septa are strongly constricting among swollen cells. Internal cell formation is strongly and conspicuously euseptate; evidence of distoseptum structure is lost or obscured from earliest stages of conidium development.

Conidia from V-8 colonies (Fig. 198) are cylindric, narrow-ovoid or ellipsoid, pale to medium brown with darker septa and outer wall (in optical section), and smooth to inconspicuously punctulate walls. Erostrate conidia range up to ca. 38-50 x 9.5-13.5μm, with 5-7 transverse septa and 1-2 longisepta in 1-3 of the transverse segments, although the narrowest conidia have no longitudinal septa. Spore bodies of rostrate conidia range to 36-53 x 10-12μm, with 4-8 transepta and 1-2 longisepta in 2-4 of the transverse segments, plus solitary septate beaks ca. 82-205 x 2μm. The conidium apex may remain beakless, or produce a filiform beak, or initiate a secondary conidiophore up to ca. 20μm long.

Conidia from PCA colonies (Fig. 199) may remain erostrate or produce a short secondary conidiophore, thus initiating chain formation. However, a very high and conspicuous percentage of juvenile conidia initiate a filiform beak that may become up to 5-6 times as long as its spore body. These rostrate conidia become ovoid or ellipsoid, moderate brown with darker outer wall and septa, and smooth

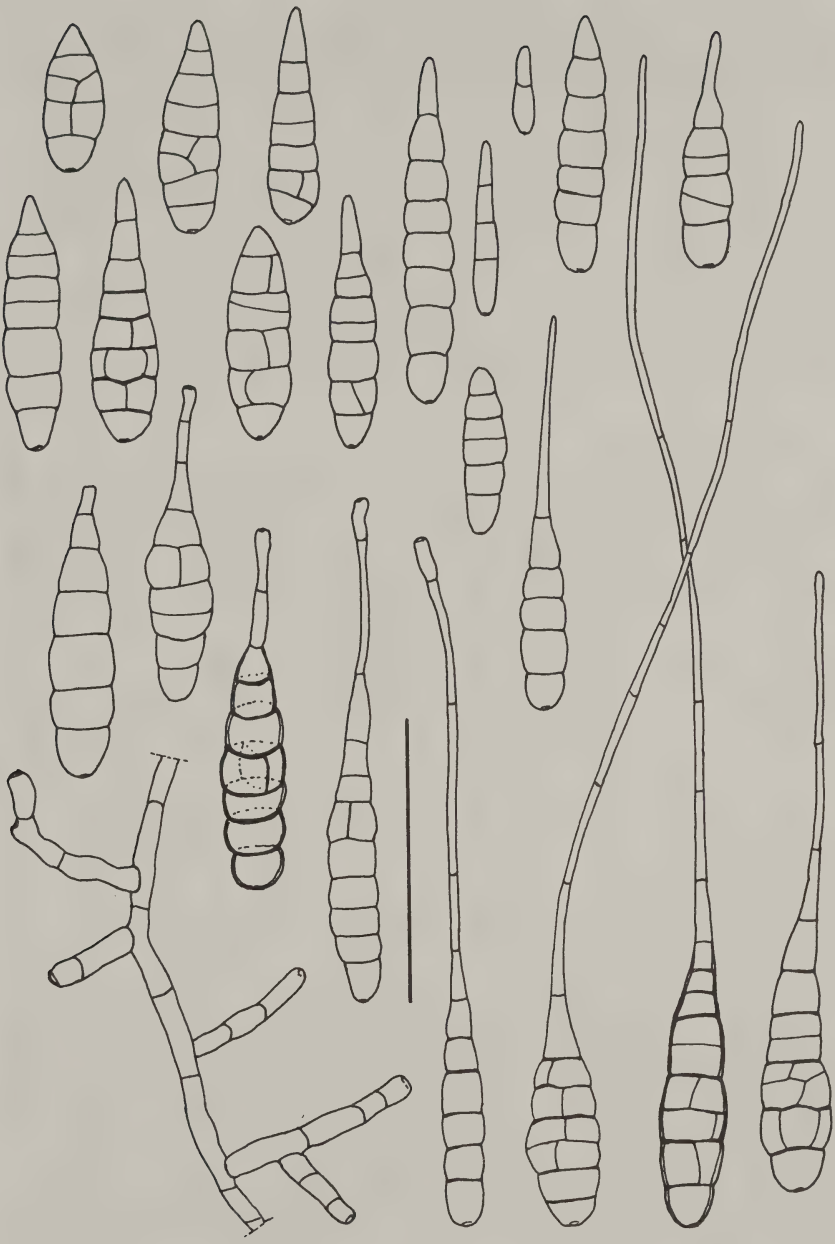

Fig. 198. *Alternaria elegans*: conidia and conidiophores ex holotype BPI 746452 (EGS 45-072) on V-8. Bar = 50μm.

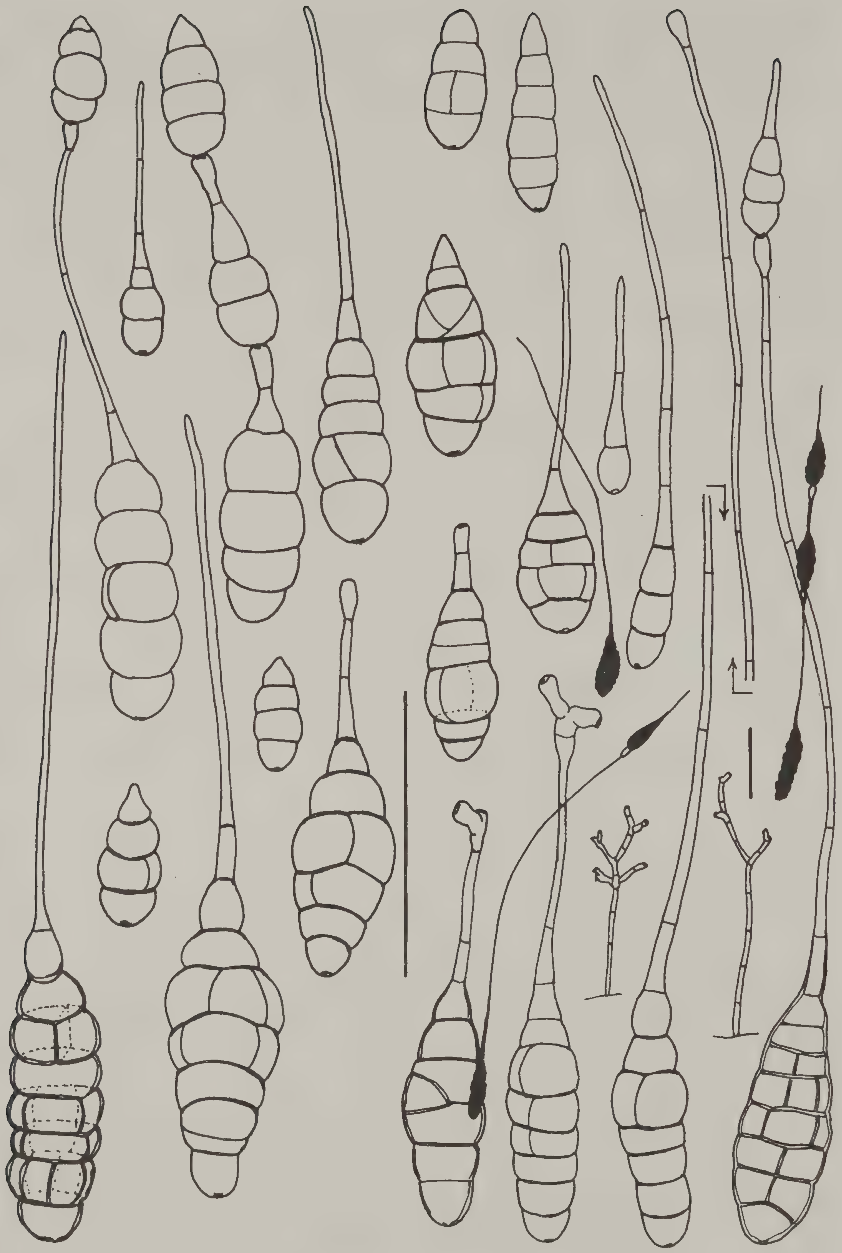

Fig. 199. *Alternaria elegans*: left of long bar, conidia of EGS 45-072 on Hay agar; right, on PCA. Bar = 50μm.

to punctulate walls. Size range is up to 30-69 x 13-16μm, with 7-10 transverse septa and 1-2 longitudinal or oblique septa in 1-5 transverse segments. Solitary filiform beaks commonly range up to 225-275 x ca. 2μm, and are sparsely but distinctly septate; short to even very long beaks frequently terminate in a small slightly enlarged secondary conidiophore cell, which generates chains of 2-4 additional conidia. Conidiophore production on PCA is similar in large part to that found on V-8, i.e., short conidiogenous branches from long arching aerial hyphae. However, large numbers of conidiophores also arise singly and directly from the agar surface; these erect conidiophores, up to ca. 75-200μm tall, develop an apical complex of short-branched, geniculate conidiogenous extensions that support a cluster of up to 5-7 conidia.

Conidia from Hay colonies (Fig. 199) may remain erostrate, or produce a short secondary conidiophore and initiate a chain of a few spores, or very commonly produce a long filiform beak. The filiform beak itself may enlarge at its tip to form a small secondary conidiophore. Conidium bodies are ovoid or ellipsoid, smooth, and appear dilute brown with darker brown outer wall and septa. Size range is up to 50-77 x 16-24μm, plus filiform beaks 65-112 x 2μm. Practically every conidium body produced on Hay is strongly constricted among conspicuously swollen cells. Septation reaches 6-9 transverse, with no longisepta in narrowest conidia or 1-2 in 1-3 of the transverse segments.

284. **Alternaria nitrimali** Simmons and Palm, sp. nov.

Fig. 200

Etym.: L., *nitrum* + *mali*, latinization of a colloquial name, (tropical) soda apple, for host *Solanum viarum* Dunal.

Ex cultura in agaro V-8 descripta. Hyphae aeriae coloniae longae, distinctae, radiatim procumbentes, ad apicem conidiogenae. Sporulatio ex conidiis solitariis, brevicatenatis vel parvicaespitulis constans. Conidiophora primaria solitaria, 320-700+ x 5μm, simplicia vel ramis longissimis, divergentibus, ad apicem uniconidiogenis vel 1-4 geniculatis et conidiogenis. Conidia primaria solitaria (99%), interdum (1%) pseudorostrata vel longifilamentose eurostrata, obscure dilute brunnea, laevia vel inconspicue punctulata. Conidia erostrata ad (56-)74-83 x (13-)15-19μm, 7-10 transverse septata, 1 longiseptata in 1-3 segmentis transversis; conidia eurostrata ad 70-87 x 14-17.5μm (corpus), 115-186 x ca. 2μm (rostrum). Habitatio typi in laesionibus foliorum Solanum viarum Dunal, specimen lectum Tropical Soda Apple Survey, *USDA-APHIS no. 98-HN-036, Luguillo, Puerto Rico, 26.ii.1998 (EGS 46-151). Typus: partes ex cultura EGS 46-151 desiccatae et in **BPI** 746453 (holotypus) et saltem in **IMI** (isotypus) conservandae.*

The type of *A. nitrimali* is based on an isolate from a leaf spot of tropical soda apple (*Solanum viarum* Dunal), collected in Puerto Rico during the 1998 USDA-APHIS Tropical Soda Apple Survey. Tropical soda apple is an invasive spiny weed of pastures. Native to Argentina and Brazil, it only recently (ca. 1987) has become a pest in pastures in southern U.S.A. (Mullahey et al. 1993) and now apparently in Puerto Rico. Conidia were present on leaf lesions of the original specimen. Fresh sporulation was abundant on leaves held in a damp chamber overnight; the ex-type isolate was chosen from among numerous 1-conidium selections from such a fresh crop of spores.

The 7-day V-8 colony is composed of a crowded but not dense growth of long, radiating, aerially procumbent hyphae, all of which are conidiogenous at or near their tips. The forward-leaning hyphae are individually discernible at 50X and, though branched to some extent, are not intertwined in the sort of woolly texture found in V-8 colonies of many of the *Alternaria* taxa discussed here. Conidium production at or on the agar surface is uncommon. Aerial conidia are solitary, in short chains, or in small clumps generated by short, branching and geniculate secondary conidiophores.

Colony development and sporulation on PCA are essentially the same as those on V-8. Much of the sporulation on Hay is from short conidiophores that arise directly from the agar surface. There are small numbers of the characteristic long, procumbent sporulating hyphae radiating from the center of the Hay colony, but they do not dominate the colony.

Primary conidiophores of *A. nitrimali* on V-8 are 320-700+ x 5μm, either unbranched or commonly with very long divergent branches that become loosely entangled in the air. Conidiophores may have only a single conidiogenous site at the tip, or very often they are closely 1-4 geniculate and conidiogenous at the tip but not lower.

Conidia are solitary or occur very commonly in short chains of 2-3, forming tiny clumps at the conidiophore tip. Well-developed erostrate conidia dominate the 7-day population at ca. 99%. However, the conidium body may continue development at its apex, usually by initiating a broad secondary conidiophore of variable length (ca. 30-40μm), which itself often becomes apically geniculate and conidio-

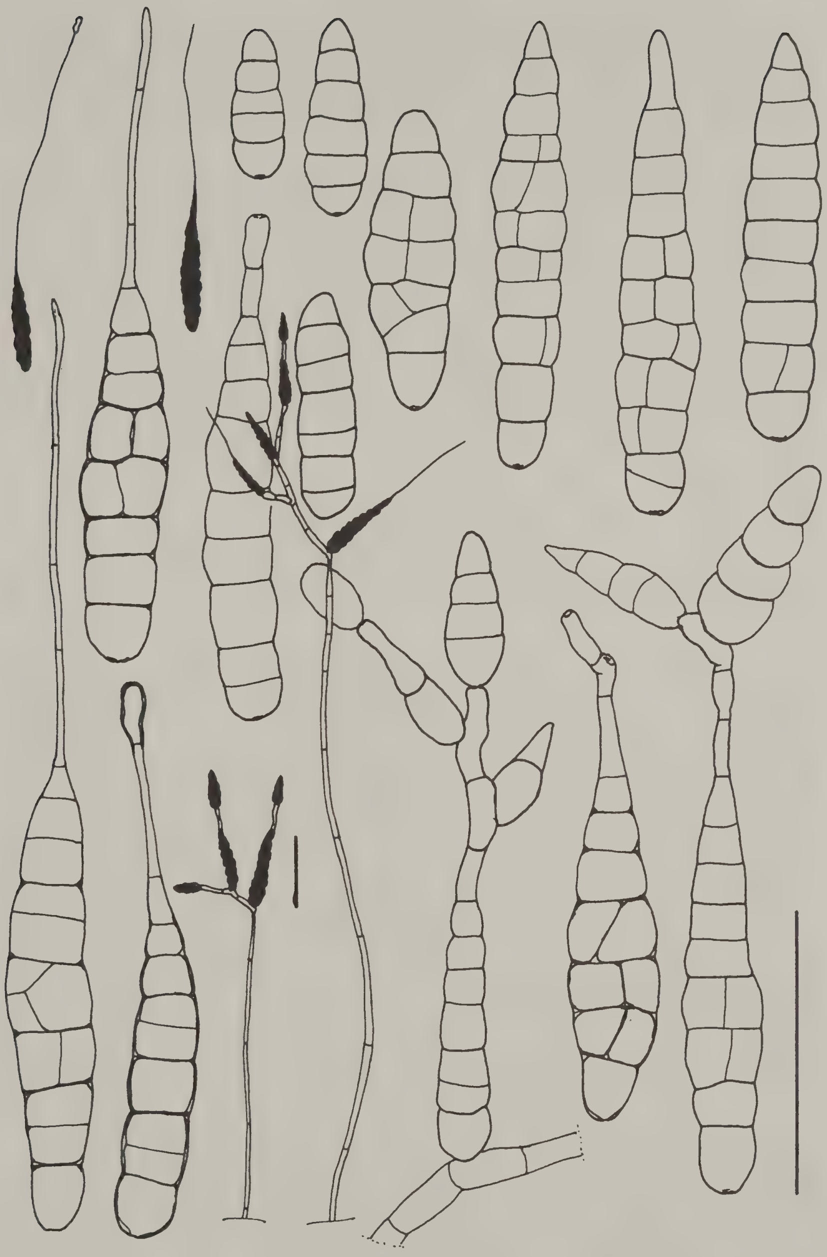

Fig. 200. *Alternaria nitrimali*: conidia and conidiophores ex holotype **BPI** 746453 (EGS 46-151) on V-8. Bars = 50μm.

genous in 2-3 sites. Occasionally (ca. 1% at 7-days) the initially erostrate conidium can be seen to have produced a long filamentous beak that is very narrow throughout its length. Sometimes this filamentous beak becomes converted apically into a distinctly enlarged secondary conidiophore.

Dominant erostrate conidia reach a range of (56-)74-83 x (13-)15-19, with 7-10 transverse septa and only 1 longiseptum in 1-3 of the transverse segments. The less abundant eurostrate conidia have spore bodies up to 70-87 x 14-17.5μm, plus a beak 115-186 x ca. 2μm, and with 8-10 transepta and 1 longiseptum in 2-3 of the transverse segments. Conidia are smooth or inconspicuously punctulate and dull pale tan. The initial distoseptate condition remains fairly conspicuous, with eusepta readily visible through a few of the distosepta but remaining inconspicuous or lacking in others.

285. **Alternaria grandis** Simmons, sp. nov. Fig. 201

Etym.: L., *grandis*, large, of conidium size in comparison with those of other taxa of the narrow-beaked species of *Alternaria*.

Ex cultura in agaro V-8 descripta. Colonia reticulata ex hyphis radiantibus, ramificantibus, anastomosantibus constans. Conidiophora primotina solitaria, erecta, simplicia, uniconidiogena; conidiophora serotina (coloniis 7-10 d.) binata vel caespitosa, ramosa, geniculata, ad 115-200 x 8-11μm. Conidia solitaria (raro 2-catenata), longe anguste obclavata, rostro longo, gradatim decrescenti, septato; rostra vulgo singularia, interdum binata, raro trinata; conidia 141-192 x 26-38μm (corpus), 160-200 x 6.4⟶2.5μm (rostrum), obscure dilute vel modice brunnea, 11-19 transverse septata, 1-3 longiseptata in 1-5 segmentis transversis, euseptis maturis atrobrunneis. Habitatio typi in laesionibus foliorum Solanum tuberosum L., specimen B. J. Christ lectum, Centre County, Pennsylvania, U.S.A., ix.1996 (EGS 44-106). Typus: partes ex cultura EGS 44-106 desiccatae et in **BPI** *746454 (holotypus) et saltem in* **IMI** *(isotypus) conservandae.*

Isolation work with early-blight leaf lesions of potato, supplied by B. Christ from Centre County and Clarion County, Pennsylvania, yielded several 1-conidium isolates (from both counties) whose growth characters in culture as well as conidium morphology differ distinctly from those of typical *A. solani*. Especially striking, as mentioned in discussion of *A. solani* (*Alt.T&V* 258), are conidium dimensions of *A. grandis*, which range to at least 50%, frequently to 100% greater than the upper range for typical *A. solani*.

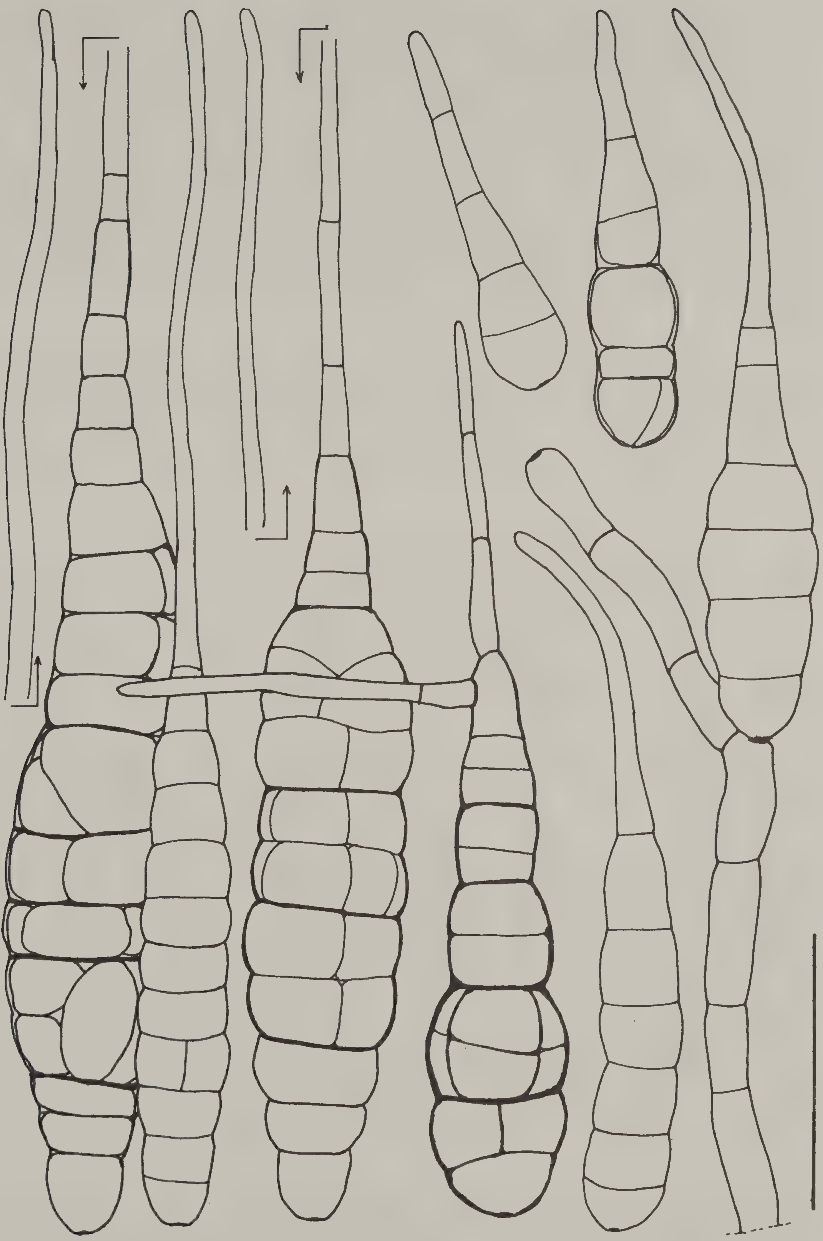

Fig. 201. *Alternaria grandis*: conidia and conidiophores ex holotype **BPI** 746454 (EGS 44-106) on V-8. Bar = 50μm.

The 7-day V-8 colony is composed primarily of broad (up to 14μm), conspicuously radiating hyphae that branch, anastomose among themselves, and often are constricted at cross septa. These hyphae form a dark but not opaque surface network from which robust conidiophores arise. Narrow, erect, non-conidiogenous hyphae are scattered among the conidiophores, but they do not disguise the essentially surface-radial aspect of the V-8 colony. Conidiophores and their conidia are scattered singly over most of the colony, but are most abundant in peripheral concentric rings that represent the positions of the colony margin on the 4th to 6th days of light exposure.

Colony development on PCA also is radial but paler and less dense than that seen on V-8. Sporulation on PCA is sparse and occurs mostly at the periphery of a 7-day colony. Colony development on Hay is very thin and unpigmented, with a few conidia produced in the center of the 7-day colony but not elsewhere.

Primary conidiophores of *A. grandis* arise directly from the broad surface hyphae; they are solitary and simple and bear a single conidium during early growth of the colony but later (10+ days) develop in pairs or as tufts of irregularly branching and geniculate conidiophores and conidia. The dark, septate conidiophores are as large as 115-200 x 8-11μm.

Conidia from V-8 colonies (Fig. 201) are, for *Alternaria*, enormous—commonly becoming 50-100% larger than typical *A. solani* and, at their largest, even longer than those of *A. brassicae* (*Alt.T&V* 135, Simmons 1995). Conidia are solitary; a rare secondary conidium may arise from a secondary conidiophore that develops from a beak tip, from the side of a beak, or laterally from a body cell. The typical conidium has a long narrow-obclavate body with a long, septate beak that tapers gradually from a broad base to a narrow tip; the beak is never uniformly filiform throughout its length. Median and submedian cells of the relatively narrow body enlarge, yielding a broadly obclavate body in largest conidia. The initial beak from the apical body cell usually remains unbranched, but a secondary beak (rarely a third) frequently is produced from the same apical cell.

Conidia are a dull, dilute to medium tan; mature eusepta are dark brown, well defined across the intercellular distoseptum matrix, and slightly to moderately constricting. Outer walls are smooth or sometimes partially and very inconspicuously punctulate. One-beaked conidia have bodies 141-192 x 26-38μm, plus a beak 160-200 x 6.4$\longrightarrow$2.5μm. Two-beaked conidia have bodies 128-198 x 24-30μm, plus beaks 99-160μm and 88-128μm that also taper gradually from base to tip. Conidium bodies have 11-19 transverse septa plus 1-3 longisepta in 1-5 of the transverse segments.

Considering the comparatively great size of conidia of *A. grandis* among ex-Solanaceae isolates, there is an initial question as to whether *A. crassa* might have leapt successfully to potato leaves from its usual weedy field host *Datura stramonium*. The suspicion is unfounded. Conidium measurements of the two from V-8 cultures (body + beak):

A. crassa	122-135 x 19-26μm + 320-460 x 6-8⟶3μm
A. grandis	141-192 x 26-38μm + 160-200 x 6.4⟶2.5μm

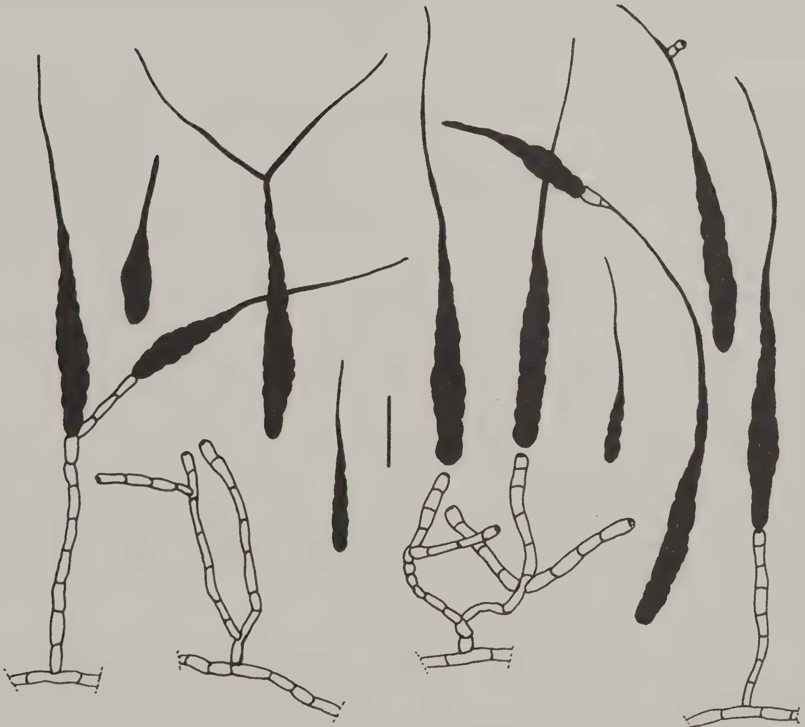

Fig. 202. *Alternaria grandis*: conidia and conidiophores ex holotype **BPI** 746454 (EGS 44-106) on V-8. Bar = 50μm.

The upper size range of *A. crassa* conidium bodies barely reaches the lower range of *A. grandis* conidia formed under the same conditions. The strikingly long beak of *A. crassa* conidia, commonly 2-3 times as long as the conidium body, contrasts with those of *A. grandis* , which are about equal in length to the conidium body. Conidia of *A. crassa*, often catenulate in culture, arise from simple conidiophores, whereas conidia of *A. grandis* eventually occur in bushy clumps as products of branching, geniculate conidiophores.

Large-spored Alternaria Taxa on *Solanum melongena*

Alternaria beringelae was introduced in *Alt.T&V* 257 as a new name to replace *Sporidesmium melongenae* Thümen (1881), an untenable early name for the one large-spored, filiform-beaked taxon described thus far from eggplant. Neither *A. beringelae* nor any other large-spored taxon found on *Solanum melongena* is known to me in culture.

Several **IMI** accessions of large-spored *Alternaria* on eggplant in Africa are close enough to M.B. Ellis's concept of *A. solani* that he identified them as such (some may be, others are not). This wealth of similar but certainly not identical specimens from African locales (originally Ethiopia, Kenya, Northern Rhodesia, Nyasaland) suggests a search for living material for study in culture. Erecting several new species on the basis of these field specimens—or lumping all into one—is not a reasonable option at present.

However, another ex-eggplant *Alternaria* in **IMI** is distinctive enough in its conidium morphology that Ellis segregated it as an *Alternaria* tax. sp. XIII (**IMI** 70930, EGS 22-052). Conidia of this specimen have an overall larger, darker, and more robust appearance than do those of *A. beringelae* (*Alt.T&V* 257), *A. solani* (*Alt.T&V* 258), and *A. tomatophila* (*Alt.T&V* 266); they give no evidence of developing the kinds of long, narrow, branching beaks that are typical of the latter two species or the kind of very long, sturdy beaks found in *A. beringelae*.

The taxon is distinguishable as a dried field specimen. It is described here as a new species, in the hope that it also may be recognized again and brought into pure culture for comparison with other *Alternaria* taxa on Solanaceae.

286. **Alternaria africana** Simmons, sp. nov. Fig. 203

Etym.: geogr., Africa, where fresh material seems most likely to exist.

Conidia juventute ovoidea, erostrata, ad 60-90µm longa, 6-9 transverse septata, dein late ovoidea et fortiter rostrata, 140-160 x 22-27µm (rostro 40-60µm incluso), obscure dilute brunnea, pariete et septis fuscatis, 10-14 transverse septata, 1-3 longiseptis in aliquot segmentis transversis. Habitatio typi in laesionibus foliorum Solanum melongena L., Zambia. Holotypus: IMI 70930, A. Angus lectum M.360, prope Kafue, Northern Rhodesia [Zambia], 27.vi.1957 (EGS 22-052).

Juvenile conidia of *A. africana* are ovoid and lack a definable beak extension until they have become ca. 60-90µm long and are 6-9 transeptate. Conidium bodies remain broadly ovoid as they enlarge and develop a sturdy beak. The beak is initiated as a slightly swollen, pale extension of the apical body cell, which lengthens and tapers slightly into a blunt, rounded apex. The identity of the characteristic swollen apical cell is lost as the spore body widens and lengthens. Largest conidia reach a size range of 140-160 x 22-27µm, of which length the sturdy beak forms ca. 40-60µm. The conidium body color is dilute dull brown, with the outer wall and several of the transepta appearing much darker. The beak extension is comparatively pale.

Largest conidia have 6-9 conspicuous and moderately constricting primary transverse septa plus 4-5 paler, non-constricting secondary transverse septa and 1-3 longitudinal or oblique septa in as many as 7 of the transverse segments. The outer wall appears to be quite smooth.

A very similar taxon is represented in Roumeguère's *Fungi selecti exsiccati* no. 7237 (1897) (EGS 06-018), which is labeled with a nomen nudum, "*Macrosporium solani* forma *lycopersici*." The fungus is on leaves of "*Solanum Lycopersicon*." Conidium development follows the same pattern as does that of *A. africana*, i.e., juvenile ovoid, erostrate conidia initiate an apical swelling that gradually extends as a relatively short, broad, sturdy beak in largest spores. However, there are enough differences between the two in transeptum prominence and wall ornamentation in mature conidia that only fresh material compared in culture is likely to support or disallow their mutual identity.

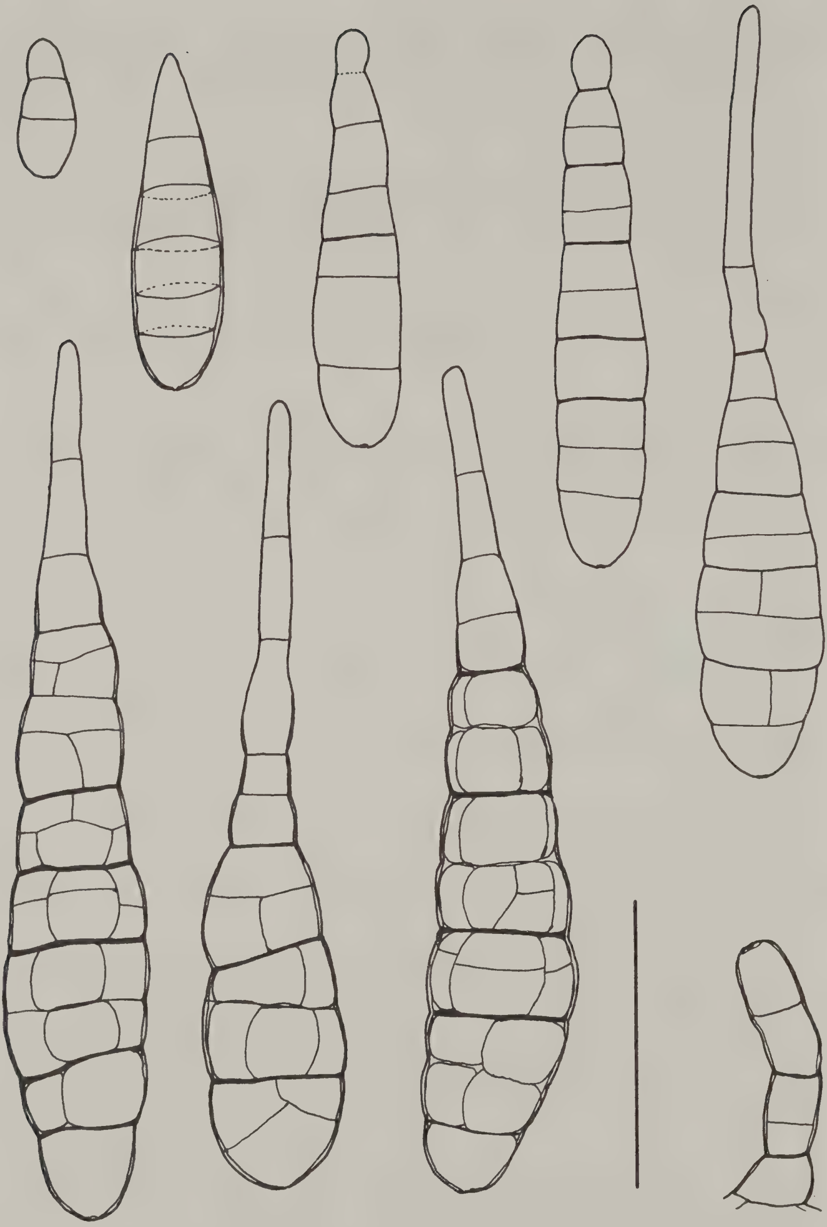

Fig. 203. *Alternaria africana*: conidia and conidiophore ex holotype IMI 70930. Bar = 50μm.

Invalid *Alternaria*-related Names (Solanaceae Substrates)

A list of ambiguous cataloguing, synonymy, nomen nudum and similar invalidly published entries.

Alternaria tenuis Sor. f. *jaczewskii* Baransky; a nomen nudum indicated as "nova forma" in three places in Serbinov (1927) but never with diagnosis or description; on ring spot of tomato fruit.

Cercospora crassa f. *solani-nigri* Massalongo (1900); a nomen nudum, in that the host lesions are described but not the fungus itself. Neergaard (1945) listed the forma as *solani-nigri* Ferraris (1912), who, however, attributed it correctly to Massalongo.

Macrosporium melongenae; a name used in the legend of an illustration by Bouriquet (1946); an obvious lapsus in his presentation of *M. poissoni* in the same paper.

Macrosporium poissoni Bouriquet; a name published twice by Bouriquet——first as a nomen nudum (1939) and later without a validating Latin diagnosis or description (1946); the original specimen on eggplant (PC, EGS 10-048) has abundant small conidia similar to those of *A. polytricha* (*Alt.T&V* 269).

Macrosporium solani "Ravenel" f. *gallica* Fautrey (1895); a nomen nudum; on leaves of *Solanum tuberosum* "var. *Americana*."

Macrosporium solani "Ravenel, Ell. et Mart.; Sacc. Forma *Lycopersici*"; a nomen nudum in Fautrey (1897); on leaves of "*Solanum Lycopersicon*."

Macrosporium solani Ell. et Mart f. *melangena* [sic] Serbinov; a nomen nudum in Serbinov (1927); on leaf and fruit of eggplant. Noted in *Revew of Applied Mycology* 6: 538 (1927) as *Alternaria solani* f. *melongenae* Serb. and in Joly (1964) as a questioned synonym of *Alternaria...solani*.

Sporidesmium dolichopus Passerini; a nomen nudum in Thümen (1881); on *Solanum tuberosum*.

Sporodesmium tabaci; a nomen nudum in Preissecker (1916), where it was mentioned only incidentally in his discussion of his *A. brassicae* var. *tabaci*.

APPENDIX: Specimen/Isolate Source Data

EGS no. *EGS opinion* Herb. "Source information."
↓ ↓ ↓ ↓

01-040 *Alt. solani*: **ANSP** "Macrosporium solani E. & Martin/Host, in foliis Solani tuberosa/Locality, Newfield, N.J./Leg., J. B. Ellis 1882. Herbarium of Geo. Martin No. 641."

01-042 *Alt. subtropica*: **ANSP** "H. W. Ravenel - Fungi Americani Exs...603. Macrosporium tomato. Cke. on fruits of Tomato. Aiken, S. Car. (in Dr. George Martin Collection)."

01-056 *Alt. mimicula*: Ex-type isolate, ex Lycopersicon esculentum transplants, Georgia, U.S.A. (S. E. A. McCallan?); in QM Culture Collection QM 280 before 1950. [Holotype BPI 803024]

01-117 *Alt. crassa*: **WIS** "Kabát et Bubák: Fungi imperfecti exsiccati/ 694. Alternaria Daturae (Fautr.) Bubák et Ranojevič...Auf Blättern von Datura Stramonium L. beim Kloster Rača, Bezirk Užice, Serbien. 25 August 1909. N. Ranojevič."

03-037 *Alt. crassa*: **NY** "C. Roumeguère. Fungi sel. exs./ 6561. Macrosporium Daturae (sp.n.) Fautr...Sur feuilles de Datura Stramonium, ...oct. 1893. F. Fautrey."

03-046 *Stemphylium* sp.: **NY** "Macrosporium esculentum E. & E./ on eggplant (dried up) [fruit], Newfield, N.J. March 13. 1893. [Ellis Collection] 3602a."

03-078 *Alt. capsici-annui*: **NY** "Herbarium Mycologicum Romanicum/Prof. Dr. Tr. Săvulescu/Fasc. XIV. no. 658./ Alternaria Capsici-annui Săvul. et Sandu nov. spec...In pericarpio Capsici annui culti... Mentenia, distr. Ilfov—Bucureşti—1/VII/1932."

03-094 *Alt. longipes*: **NY** "Macrosporium longipes, E. & E./ On leaves of Tobacco (Nicotiana Tabacum). Raleigh, N.C. Oct. 91. Prof. Gerald McCarthy."

04-132 *Alt. tabacina*: **NY** "Macrosporium tabacinum E. & E./ On leaves of tobacco (Nicotiana Tabacum), Raleigh, N.C. Oct. 1891, Prof. Gerald McCarthy."

04-165 [*taxon incert. sed.*]: **NY** "C. Roumeguère. Fungi sel. exs. 6559. Macrosporium Brassicae f. Solani... Sur feuilles de Solanum nigrum. Rec. cl. Paul Brunaud. F. Fautrey."

04-166 [*taxon incert. sed.*]: **NY** "C. Roumeguère. Fungi sel. exs. 6559. Macrosporium Brassicae f. Solani... Sur feuilles de Solanum nigrum. Rec. cl. Paul Brunaud. F. Fautrey." [dupl.]

06-010 *Alt. crassa*: **NY** "Macrosporium Solani Cooke/On Datura stramonium/Coll. Ravenel 3344. Aiken, S.C./ Det. M. C. Cooke/Oct., 1881/Ex Herb. Ellis/Type Gathering."

06-017 [*nomen nudum*]: **NY** "C. Roumeguère. Fungi sel. exs. 7237. Macrosporium Solani Ravenel, Ell. et Mart.; Sacc. Forma Lycopersici Macrosporium Tomato, Cke. Sur feuilles de Solanum Lycopersicon. Automne 1896. F. Fautrey."

06-018 [*nomen nudum*]: **NY** "C. Roumeguère. Fungi sel. exs. 7237. Macrosporium Solani Ravenel, Ell. et Mart.; Sacc. Forma Lycopersici Macrosporium Tomato, Cke. Sur feuilles de Solanum Lycopersicon. Automne 1896. F. Fautrey." [dupl.]

06-027 *Alt. solani*: **NY** "Macrosporium Solani, E. & M./in foliis Solani tuberosi 1882/del Dr. Martin."

06-032 *Alt. tomato*: **NY** "Macrosporium Tomato Cke./Hab. Lycopersicon esculentum/Loc. Palmetto, Fla./Coll. G. F. Weber/Date 5/19/'35/Det. G. F. Weber No. 10444."

08-008 *Alt. crassa*: **FH** "Macrosporium Solani Cke./on Datura stramonium/Coll. H. W. Ravenel. 3344. Aiken, S. C./ Oct. 1881/Det. Cooke/ex Herb. Ellis/55 specimens 3344 HWR."

08-098 *Alt. crassa*: **NYS** "Cercospora daturae Pk./Loc. Cold Spring/Leg. C. H. Peck/TYPE/Coll. N. Y. State."

10-048 [*nomen invalidum*]: **PC** "Macrosporium poissoni Bouriquet/Herbier Pathologique de Gilbert Bouriquet No. 1550/Plante parasitée...aubergine/...Tananarive [Madagascar] Inst. Pasteur 19/11/37."

10-091 *Alt. beringelae*: **B** "Sporidesmium melongenae Thüm. [non *Alternaria melongenae* Rangaswami & Sambandam (1961)]/Solanum melongena/hort. Gart. Coimbra/Moller 714/9-1879."

10-166 *Alt. polytricha*: **K** "Fungi.—North America/Mystrosporium polytrichum C./on Solanum melongena, No. 2816 Ravenal [sic]//Herb. Mycol. M. C. Cooke 1885."

11-027 *Alt. tomato*: **K** "Macrosporium Tomato Cke./on ripe Tomatoes/Sept. 1880/Aiken S. C./HWR 3099//Herb. Mycol. M. C. Cooke 1885."

11-068 [*taxon incert. sed.*]: **UPS** "Macrosporium brassicae f. Solani/...Sur les feuilles de Solanum nigrum./ Octo. 1893. V-248 Fautrey."

11-075 *Alt. crassa*: **UPS** "Macrosporium Daturae sp. n./ ...Feuilles de D. Stramonium...Octo. 1893/Fautrey."

11-177 *Alt. crassa*: **PAD** "Cercospora crassa, Datura Stram., S.[elva] '76. 10."

22-052 *Alt. africana*: **IMI** "70930. Alternaria Tax. sp. XIII/Host Solanum melongena/Loc. nr. Kafue, N. Rhodesia/Col. A. Angus M.360/Date 27.6.57/PPNR 1646."

23-161 *Nimbya major*: **IMI** "106237. Type Alternaria longipes var. major Pavgi & Singh/Host Nicotiana plumbaginifolia/Loc. Deoria, India/Col. U. P. Singh IV [M.S.P. 325]/Date July 1963."

24-143 *Alt. tomato*: **IMI** "1036. Alternaria tomato/Host Lycopersicon/Loc. Gainesville, Fla. U.S.A./Col. G. F. Weber/Date 6/20/32/Herb. Ag. Exp. Sta. Univ. Fla. 7788."

29-125 [*taxon incert. sed.*]: **HCIO** "26663 Alternaria melongenae Rangaswami & Sambandam/Solanum melongena/India; Annamalainagar, Madras/C. V. Sambandam/10 Nov. 1958."

39-128 *Alt. arborescens*: Ex-type isolate, ex "Alternaria alternata f. sp. lycopersici, tomato plant pathogen, stem canker pathogen, AS27-3pz, gen 7, 4-23-90 [Dept. Plant Pathology, University of California, Davis]." [Holotype **BPI** 749422]

40-058 *Alt. cyphomandrae*: Ex-type isolate, ex "Alternaria sp. ex fruit of Cyphomandra betacea (tamarillo), May 1991, New Plymouth, New Zealand, LYN 6414.1 [Lynfield Plant Protection Centre, Auckland, New Zealand]." [Holotype **BPI** 746451]

40-161 *Alt. rugosa*: **VPRI** "Macrosporium rugosum, on tomato, Sale, 5 Feb. 1896, Dr. Reid [slide 105]."

42-156 *Alt. tomatophila*: Ex-type isolate, ex leaf spot of Lycopersicon esculentum, Montgomery Co., Indiana, 23 Aug. 1995, coll. and isol. E. G. Simmons. [Holotype **BPI** 746447]

43-110 *Alt. solani*: **VT** "F2921 Herb. L. R. Jones/Macrosporium solani E. & M./On leaves of Cult. Potato (Var. White Star) from which painting was made Aug. 1892 for Columbia Exposition."

44-071 *Alt. crassa*: Representative isolate, ex leaf spot of Datura stramonium, farm field, Montgomery Co., Indiana, 1 Aug. 1996, coll. & isol. E. G. Simmons.

44-098 *Alt. solani*: Representative isolate, ex leaf spot of Solanum tuberosum, farm field, Douglas Co., Washington, 25 Aug. 1996, coll. & isol. E. G. Simmons.

44-106 *Alt. grandis*: Ex-type isolate, ex leaf spot of Solanum tuberosum, Centre Co., Pennsylvania, Sept. 1996, coll. B. J. Christ, isol. E. G. Simmons. [Holotype **BPI** 746454]

45-020 *Alt. solani*: Representative isolate, ex tuber of Solanum tuberosum, Siskiyou, California, coll. & isol. D. Fogle.

45-053 *Alt. solani*: Representative isolate, ex Solanum tuberosum, Hastings, New Zealand, March 1997, isol. C. F. Hill.

45-072 *Alt. elegans*: Ex-type isolate, ex seed of Lycopersicon esculentum, Burkina Faso, via IMI 374542, May 1997. [Holotype **BPI** 746452]

45-075 *Alt. capsici*: Ex-type isolate, ex Capsicum annuum, Australia, via IMI 262408, May 1997; ex DAR 37795, coll. D. Trimboli, May 1981. [Holotype **BPI** 746450]

45-113 *Alt. subcylindrica*: Ex-type isolate, ex leaf lesion Lycopersicon esculentum var. cerasiforme, Louisiana State University Burden Research Plantation, Baton Rouge, Louisiana, 2 July 1997, coll. and isol. R. G. Roberts 97.0057. [Holotype **BPI** 746448]

45-161 *Alt. subcylindrica*: **FLAS** "F13520 Alternaria solani/ Hab. Tomato/Loc. Reddick, Fla./Coll., Det. Weber & Kelbert no. 7864/Date 7-21-32."

45-173 *Alt. subcylindrica*: **FLAS** "F20289 Alternaria solani/ Hab. Lycopersicon esculentum/Loc. Bradenton, Florida/Coll., Det. G. F. Weber no. 12253/Date 5/7/38."

45-174 *Alt. subcylindrica*: **FLAS** "F22208 Alternaria solani/ Hab. Lycopersicon esculentum/Loc. Gainesville, Fla./ Coll., Det. G. F. Weber no. 12710/Date 5/16/10."

45-175 *Alt. subcylindrica*: **FLAS** "F22529 Alternaria solani/ Hab. Lycopersicon esculentum/Loc. Bradenton, Fla./ Coll, Det. G. F. Weber no. 13061/Date 1-6-40."

45-177 *Alt. subcylindrica*: **FLAS** "F43428 Alternaria solani/Lycopersicon esculentum/Escuela Agricola Panamericana, Honduras/Col. A. S. Muller No. 485/ February 2, 1951."

45-196 *Alt. beringelae*: **FLAS** "F13532 Alternaria solani/ Hab. Eggplant/Loc. Gainesville, Fla./Coll., Det. G. F. Weber no. 6081/Date 4/9/30."

45-197 *Alt. solani*: **FLAS** "F13542 Alternaria solani/ Hab. Potato/Loc. Hasting, Fla./Coll, Det. G. F. Weber/ Date 4/21/30."

45-203 *Alt. beringelae*: **FLAS** "F22127 Alternaria solani/ Hab. Melongena solani (eggplant)/Loc. Palmetto, Fla. /Coll., Det. G. F. Weber no. 12561/Date 12/4/38."

46-014 *Alt. crassa*: Representative isolate, ex leafspot of Nicandra physalodes, farm field, Montgomery Co., Indiana, 5 Sept. 1997, coll. & isol. E. G. Simmons.

46-151 *Alt. nitrimali*: Ex-type isolate, ex leafspot of Solanum viarum Dunal, coll. by Tropical Soda Apple Survey, USDA-APHIS no. 98-HN-036, Luguillo, Puerto Rico, 26.ii.1998; isol. E. G. Simmons. [Holotype **BPI** 746453]

46-178 *Alt. solani*: Representative isolate, ex Solanum nigrum, California, 1998, coll. & isol. B. Pryor.

46-188 *Alt. cretica*: Ex-type isolate, ex leaf spot of Lycopersicon esculentum, in greenhouse, Heraklio, Crete, Greece, 1997, coll. & isol. D. J. Vakalounakis. [Holotype **BPI** 746449]

47-048 *Alt. sp. indet.*: **BPI** "446329/H. W. Ravenel--Fungi Americani Exsiccati...603. Macrosporium tomato. Cke. on fruits of Tomato. Aiken, S. Car."

47-049 *Alt. subtropica*: **BPI** "446611/Alternaria solani... on Lycopersicum esculentum [fruit]/ex Mexico, intercepted at Nogales, Arizona, Feb. 7, 1955. Coll. D. E. Noel; Nogales #74293."

47-050 *Alt. subtropica*: **BPI** "446596/Alternaria solani... on Lycopersicon esculentum [fruit]/ex Mexico, intercepted at Nogales [Ariz.], March 20, 1958. Coll. D. E. Noel & J. M. Kaiser; Nogales 77728."

47-051 *Alt. subcylindrica*: **BPI** "446594/Alternaria solani ...on Lycopersicon esculentum [leaves]/Jacksonville, Texas, June 26, 1955/Coll. P. A. Young."

47-052 *Alt. subtropica*: **BPI** "446604/Alternaria solani... on Lycopersicon esculentum [fruit]/ex Mexico, intercepted at El Paso, Texas, June 20, 1956. Coll. J. W. Green; El Paso no. 55298."

47-060 *Alt. subcylindrica*: **BPI** "446623/Alternaria solani ...On leaves of cult. tomato, Ithaca, N. Y., Aug. 15, '09. Coll. H. H. Whetzel [ex **CUP** 5141]."

47-064 *Alt. subcylindrica*: **BPI** "446597/Alternaria solani/ Host Lycopersicon esculentum/Loc. Chula Vista, California/Date 1/27/38/Coll. O. A. Plunkett."

47-088 *Alt. crassa*: **BPI** "445481/Macrosporium solani Cooke [lectotype]/On Datura stramonium, Aiken, S. C., Oct. 1881. Coll. Ravenel 3344, det. M. C. Cooke."

47-120 *Alt. crassa*: **PC** "Macrosporium daturae Fautrey [lectotype]/C. Roumeguère. Fungi selecti exsiccati 6561. "Sur feuilles de Datura Stramonium..., oct. 1893. F. Fautrey."

48-032 *Alt. subtropica*: **NY** [one of six lesions of Ravenel 3099] "Macrosporium Tomato Cke./on ripe Tomatoes, Aiken, S. C., Oct. 1880, HWR 3099."

48-033 *Alt. alternata grp.*: **NY** [one of six lesions of Ravenel 3099] "Macrosporium Tomato Cke./on ripe Tomatoes, Aiken, S. C., Oct. 1880, HWR 3099."

48-034 *Alt. tomato*: **NY** [one of six lesions of Ravenel 3099] "Macrosporium Tomato Cke./on ripe Tomatoes, Aiken, S. C., Oct. 1880, HWR 3099."

48-035 *Alt. subtropica*: **NY** [one of six lesions of Ravenel 3099] "Macrosporium Tomato Cke./on ripe Tomatoes, Aiken, S. C., Oct. 1880, HWR 3099."

48-036 *Alt. tomato*: **NY** [one of six lesions of Ravenel 3099] "Macrosporium Tomato Cke./on ripe Tomatoes, Aiken, S. C., Oct. 1880, HWR 3099."

48-037 *Alt. subtropica*: **NY** [one of six lesions of Ravenel 3099] "Macrosporium Tomato Cke./on ripe Tomatoes, Aiken, S. C., Oct. 1880, HWR 3099."

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This present examination of *Alternaria* on Solanaceae was proving particularly difficult until I found it possible to enlist the help of several individuals in finding viable material on/from infected potato. Herbarium material of *A. solani* on potato had convinced me that the species was quite different than the common species long familiar to me on tomato. Abundant fresh isolates were essential to confirmation of the opinion. Practically instantaneous responses to my requests came from John Alcorn (Brisbane, Australia), Ellen Bentley (Prosser, Washington), Edward Butler (Davis, California), Barbara Christ (University Park, Pennsylvania), Diana Fogle (Sacramento, California), Frank Hill (Auckland, New Zealand), John McKemy (Syracuse, New York), and Barry Pryor (Davis, California). Scores of isolates from their *Solanum* materials left no doubt that *A. solani* and *A. tomatophila* are readily and consistently distinguishable from each other. The contributions of these individuals were, in a real sense, critical to the deconstruction of the age-old misinterpretation of the "*Alternaria solani*" group of pathogens, as presented here.

The many institutions that have allowed me to examine specimens in their charge are identified in the preceding **Appendix** by their standard acronyms or herbarium abbreviations. They are thanked for their invaluable support.

Two colleagues—Mary E. Palm and Rodney G. Roberts—have maintained steady interest in and support of what I am trying to accomplish in these notes on *Alternaria* taxonomy, for which my gratitude likewise remains steady. They again have reviewed critically and commented forthrightly on the prepublication manuscript. In spite of imposition on their good natures to perform this essential but time-consuming work, we remain good friends—which to me is a great satisfaction. Theirs are eyes of the eagle—admonishing tones of the dove.

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REVISION OF THE CHINESE AMANITA COLLECTIONS DEPOSITED IN BPI AND CUP[1]

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Abstract The material of Amanitae collected in China in the first third of this Century and deposited in BPI and CUP, USA was reexamined. All collections were identified by the late Prof. S. C. Teng. At least some of them were cited as vouchers in his papers, and books. Restudy revealed that many collections were misidentified; and hence, the names of some taxa probably have to be deleted from current catalogues of Chinese Amanitae.

Key Words *Amanita*, China, Agaricales, Basidiomycetes

While studying the Chinese Amanitae, I had an opportunity to review the *Amanita*, and *Amanitopsis* collections gathered from China in the first third of this Century and now deposited in the National Fungus Collections (BPI), Beltsville, Maryland, and in Cornell University's Plant Pathology Herbarium (CUP), Ithaca, New York. Twenty-four collections in BPI and fourteen collections in CUP were reexamined, all of which were identified by the late Prof. S. C. Teng. Some of them were formally cited in his papers (Teng, 1932a, b, c; 1936). Consequently, his later works (Teng, 1939; 1963; 1996) on Chinese *Amanita* and *Amanitopsis* at least partially depend on the collections. Critical restudy revealed that many collections were misidentified according to modern species concept; and, hence, the names of some taxa probably have to be deleted from the current catalogues of Chinese Amanitae.

Due to lack of field notes, colors of all parts of fruitbodies described in the following account are from observations on the dried specimens.

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Since many collections are now poorly rehydrating, anatomical studies were only conducted on a limited scale.

Amanita avellaneosquamosa (Imai) Imai Fig. 1

Pileus ca. 2 cm in diam., convex to applanate, occasionally covered with small, felty-fibrillose, appressed volval remnants; margin finely striate [0.1-0.15R], appendiculate. Lamellae moderately crowded to subdistant, grey-brown when dried; lamellulae truncate. Stipe 3 × 0.2-0.4 cm, slightly attenuate upwards, without bulb. Volva 2 × 1.8 cm, saccate, dirty white. Annulus fugacious. Spores (fig.1) [25/1/1][2] (7.0-) 7.5-10.0 (-10.5) × 5.0-5.5 (-6.0) µm [Q = (1.40-) 1.50-1.84 (-1.91), **Q** = 1.69 ± 0.12], ellipsoid to elongate, amyloid, colorless, hyaline, thin-walled, smooth. Clamps lacking.

Specimen examined: Kiangsu: Ling-ku-sze woods, Nanking[3], 14. VII. 1936, S. C. Li 112 (IBN[4] 5814, CUP-CH 922, as *Amanitopsis volvata*).

Remarks: Li 112 was cited as *Amanitopsis volvata* (Peck) Sacc. (Teng, 1936: 556), which differs from *A. avellaneosquamosa* by the fruitbody staining red-brown after injury, a fibrillose-floccose inner layer of volval remnants on the pileus made up of abundant, fusiform, broadly clavate to ellipsoid, loosely and irregularly arranged inflated cells; a thicker subhymenium with (2-) 3-4 (-5) layers of cells, and somewhat larger spores (Yang, 1997: 130).

Amanita chepangiana Tulloss & Bhandary Fig. 2

Pileus 5-12 cm in diam., convex to applanate, without umbo, white, glabrous, occasionally covered with white, submembranous volval remnants; margin striate [0.2-0.3R], non-appendiculate. Stipe 8-15 × 1-3 cm, subcylindrical or attenuate upwards, without bulb. Volva 5-9 × 2-5 cm, saccate, white. Annulus pendant from 0.5-3 cm below apex of stipe. Spores (fig. 2) [140/7/3] 9.0-11.0 (-12.0) × 7.5-9.5 (-10.5) µm [Q = (1.05-) 1.10-1.26 (-1.33), **Q** = 1.18 ± 0.06], subglobose to broadly ellipsoid, rarely ellipsoid, inamyloid, colorless, hyaline, thin-walled, smooth. Clamps abundant.

Specimens examined: Kiangsu: Nanking, 14. VII. 1937, S. C. Li 293

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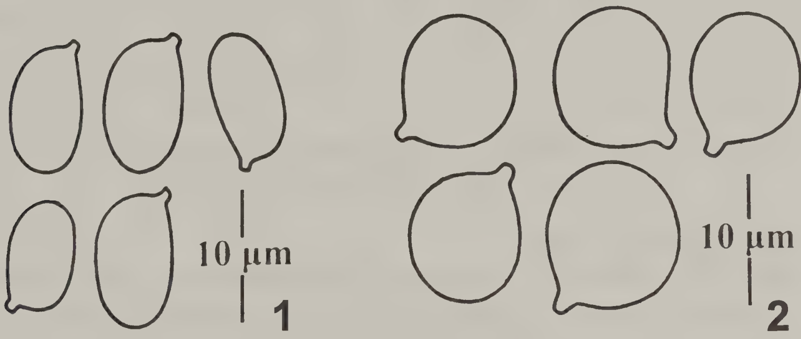
[2] 25 spores from 1 basidiocarp of 1 collection measured in 5% KOH solution; Q is used to mean "length/width ration" of a spore; **Q** means average Q of all specimens ± sample standard deviation.

[3] "Kiangsu: Ling-ku-sze, Nanking" is now written "Jiangsu: Linggusi, Nanjing".

[4] IBN = the former so called "Institute of Botany, National Central Research Academy".

(IBN *s.n.*, BPI 749950, CUP-CH 1963, as *A. caesarea* var. *alba*); Lingku-sze woods, Nanking, 14. VII. 1937, S. C. Li 188 (IBN 7491, BPI 750108, as *A. caesarea* var. *alba*); Nanking, 28. VI. 1936, H. N. Shen 318 (IBN *s.n.*, BPI 749952, CUP-CH 2082, as *A. caesarea* var. *alba*).

Remarks: Shen 318 was cited as *A. caesarea* var. *alba* Gillet (Teng, 1936: 553). *Amanita chepangiana* differs, however, from *A. caesarea* var. *alba,* described from Europe, by the longer pileal striations, longer stipe, and significantly wider spores (Tulloss & Bhandary, 1992; Yang 1997).



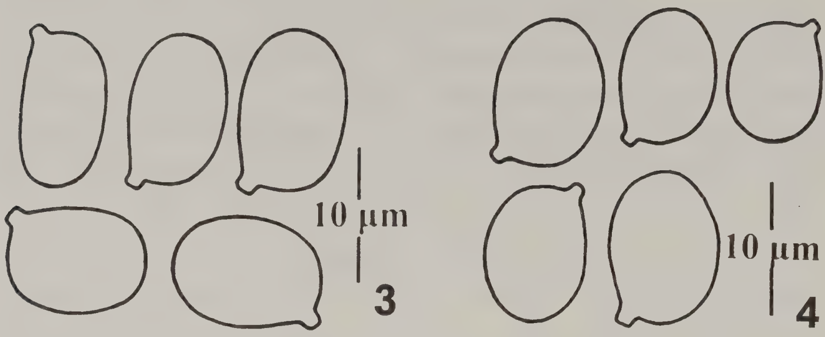
Figs. 1-2: Basidiospores of *A. avellaneosquamosa* (fig. 1, Li 112), and *A. chepangiana* (fig. 2, Shen 318).

Amanita clarisquamosa (Imai) Imai Fig. 3

Pileus ca. 3 cm in diam., ochraceous, covered with yellowish to ochraceous felty-fibrillose volval remnants; margin hardly striate, appendiculate. Lamellae crowded, brown when dried, lamellulae truncate. Stipe 3 × 0.5 cm, subcylindrical, without bulb. Volva 2.5 × 2 cm, saccate, dirty white. Annulus fugacious. Spores (fig. 3) [30/1/1] (9.5-) 10.0-12.0 (-13.0) × 6.5-8.0 (-8.5) µm [Q = (1.28-) 1.36-1.77 (-1.85), **Q** = 1.51 ± 0.14], ellipsoid to elongate, rarely broadly ellipsoid, amyloid, colorless, hyaline, thin-walled, smooth. Clamps lacking.

Specimen examined: Kiangsu: Nanking, 28. VI. 1936, H. N. Shen 312 (IBN 5722, BPI 751333, as *Amanitopsis volvata*).

Remarks: Shen 312 was formerly cited as *Amanitopsis volvata* (Peck) Sacc. (Teng, 1936: 556), which differs from *A. clarisquamosa* by the fruitbody staining red-brown after injury, a fibrillose-floccose inner layer of volval remnants on the pileus made up of abundant, fusiform, broadly clavate to ellipsoid, loosely and irregularly arranged inflated cells; a thicker subhymenium with (2-) 3-4 (-5) layers of cells, and somewhat smaller spores (Yang, 1997: 126).



Figs. 3-4: Basidiospores of *A. clarisquamosa* (fig. 3, Shen 312), and *A. hemibapha*-group (fig. 4, Teng 2726).

Amanita farinosa Schw.

Pileus 1.5-4 cm in diam., convex to applanate to concave, grey-brown, covered with brownish, yellow-brown to grey-brown, farinose volval remnants; margin long striate [0.4-0.5R], non-appendiculate. Stipe 4-8 × 0.3-0.7 cm, subcylindrical or attenuate upwards; base bulbous, 0.5-0.8 cm wide, its upper part covered with grey to brown, farinose volval remnants. Annulus lacking. Spores [65/4/2] (6.0-) 6.5-7.5 (-8.0) × 5.0-6.0 (-6.5) µm [Q = (1.09-) 1.14-1.32 (-1.36), **Q** = 1.22 ± 0.06], broadly ellipsoid, sometimes subglobose or ellipsoid, inamyloid, colorless, hyaline, thin-walled, smooth.

Specimens examined: Kiangsu: Agr. Coll., Central Univ., Nanking, 25. VII. 1931, K. L. Teng 487 (IBN 5479, BPI 751358, as *Amanitopsis farinosa*). Fukian: Kushan, Foochow[5], 14. VIII. 1934, S. C. Teng 2429 (IBN 5452, BPI 751356, CUP-CH 900, as *Amanitopsis farinosa*);

Remarks: Teng 487 & 2429 were regarded as *Amanitopsis farinosa* (Schw.) Peck (Teng, 1932a: 122), or as *Amanita farinosa* Schw. (Teng, 1936: 557). For detailed descriptions of this taxon see Yang (1997).

Amanita fritillaria (Berk.) Sacc.

Pileus 2-8 cm in diam., convex to applanate, brown to dark brown, covered with dark grey, grey-brown to blackish, conical to floccose, 1-2 mm high volval remnants; margin nonstriate, non-appendiculate. Stipe 2-7 × 0.5-1 cm, covered with grey, dark brown to blackish, fibrillose squamules; bulb subglobose, upper part often covered with dark grey to black volval remnants in 2-4 rings. Annulus present, membranous. Spores [80/6/5] (6.0-) 6.5-8.0 (-9.0) × (5.0-) 5.5-6.5 (-7.5) µm [Q = (1.08-) 1.11-1.36 (-1.45), **Q** = 1.25 ± 0.08], broadly ellipsoid to ellipsoid, rarely subglobose, amyloid, colorless, hyaline, thin-walled, smooth. Clamps lacking.

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[5] "Fukian: Kushan, Foochow" is now written "Fujian: Gu Mt., Fuzhou".

Specimens examined: Kiangsu: Ling-ku-sze, Nanking, 24. V. 1936, S. H. Ou 176 (IBN 1246, BPI 750996, CUP-CH 152, as *A. spissa*); Nanking, 6. VII. 1937, S. C. Li 310 (IBN *s.n.*, BPI 750871, as *A. spissa*); Ling-ku-sze woods, Nanking, 28. VI. 1936, H. N. Shen 308 (IBN 2098, BPI 750870, as *A. spissa*); Nanking, 12. VII. 1936, K. L. Teng 2452 (IBN 5787, BPI 750995 & 751047, as *A. spissa*); Nanking, 22. VI. 1933, S. C. Teng 2437 (IBN 5483, BPI 750990 & 750999, as *A. spissa*). On ground in woods, *e.g.* coniferous forests.

Remarks: Ou 176, Teng 2452, and Teng 2437 were formerly cited as *Amanita spissa* (Fr.) Kumm. (Teng 1936: 555), which is usually treated as a synonym of *Amanita excelsa* (Fr.) Bertillon (Jenkins, 1986: 126; Breitenbach & Kränzlin, 1995: 148). For comparison, we have studied collections of *A. excelsa* from Germany [Germany: Schönbuch bei Tübingen, 31. VII. 1994, Z. L. Yang D15 (HKAS[6] 31499); 27. VIII. 1994, Z. L. Yang D17 (HKAS 31536); 24. VIII. 1996, Z. L. Yang D97 (HKAS 31510)]. *Amanita fritillaria* differs from *A. excelsa* by its darker-colored, much firmer volval remnants on the pileus, the conspicuous dark colored, scaly ornamentation on the stipe. Microscopically, the pileipellis of *A. excelsa* is more strongly gelatinized than that of *A. fritillaria*. The elements in volval remnants on pileus of *A. fritillaria* are ± vertically arranged, and conspicuously brown to brownish vacuolar pigmented, while the elements of *A. excelsa* often tend to be loosely and irregularly arranged, and are almost colorless.

Amanita cf. ***fulva*** (J. C. Schaeff.) Fr.

Pileus 2-5 cm in diam., convex to almost applanate, slightly umbonate, brown to reddish-brown, sometimes blackish at the center, becoming paler towards margin, glabrous; margin long striate [0.25-0.5R], non-appendiculate. Lamellae often with greyish tinge when dried. Stipe 7-9 × 0.5-0.8 cm, attenuate upwards, without bulb. Volva saccate, 2-3 × 1-2 cm, white to dirty white, becoming brownish. Annulus lacking. Spores [65/3/1] (8.5-) 9.0-12.0 (-14.0) × (8.0-) 8.5-11.5 (-13.0) µm [Q = 1.0-1.12 (-1.14), **Q** = 1.06 ± 0.04], globose to subglobose, inamyloid, colorless, hyaline, thin-walled, smooth. Volva on stipe base: outer surface of volva comprising ± gelatinized filamentous hyphae; under the outer surface with a layer ca. 100 µm thick made up of scattered but conspicuous vascular hyphae, 3-10 µm wide, dominantly mixed with filamentous hyphae 2-7 (-12) µm wide; inflated cells scattered in this layer, but becoming fairly abundant in the inner layer, subglobose to ovoid to ellipsoid (50-70 × 30-60 µm), hyaline, thin-walled, single and terminal, occasionally intercalary, rarely 2-3 in chains; inner surface gelatinized.

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[6] HKAS = Herbarium of Cryptogams, Kunming Institute of Botany, Academia Sinica, Heilongtan, Kunming, China.

Specimen examined: Chekiang: Tien-mu-shan[7], 30. VI. 1932, S. C. Teng 1107 (IBN 5442, BPI 751431, CUP-CH 897, as *Amanitopsis vaginata*).

Remarks: This is probably not the same species as I described under the name *Amanita* aff. *fulva* in my thesis (Yang, 1997: 80). Teng 1107 was regarded as *Amanitopsis vaginata* (Bull.: Fr.) Roze (Teng, 1932c: 68; 1936: 556). But the color of dried pileus suggests *A. fulva* (J. C. Schaeff.) Fr. It differs from the latter by, among other characters, the anatomy of the volva. The taxonomy of "*Amanita fulva*" from China will be discussed in detail in another paper.

***Amanita hemibapha*-group** Fig. 4

Pileus 3-7 cm in diam., convex to applanate, often umbonate, glabrous; margin striate [0.15-0.3R], non-appendiculate. Lamellulae truncate. Stipe 6-10 × 0.5-1.5 cm, subcylindrical or attenuate upwards, often with scaly zones, without bulb. Volva 1.5-3 (-5) × 1-2.5 cm, saccate, white to whitish. Annulus pendant from 1-3 cm below apex of stipe. Spores (fig. 4) [120/6/2] (8.0-) 9.0-11.5 (-12.5) × (6.0-) 6.5-8.0 (-9.0) µm [Q = (1.11-) 1.25-1.67 (-1.79), **Q** = 1.45 ± 0.14], broadly ellipsoid to ellipsoid, rarely subglobose, rarely elongate, inamyloid, colorless, hyaline, thin-walled, smooth. Clamps common.

Specimens examined: Kiangsu: Nanking, 13. VI. 1937, S. C. Teng 2726 (IBN *s.n.*, BPI 90087, CUP-CH 2203, as *A. caesarea*); Ling-ku-sze woods, Nanking, 9. VII. 1937, S. C. Li 266 (IBN 7609, BPI 900082, CUP-CH 1189, as *A. caesarea*).

Remarks: Since there are no field notes accompanying the specimens, it is difficult to give a reliable identification. Mushrooms of the *A. hemi-*

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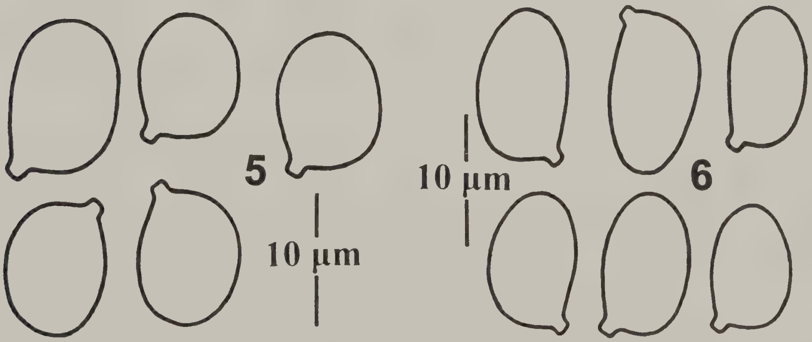
[7] "Chekiang: Tien-mu-shan " is now written "Zhejiang: Tianmu Mt."

bapha complex in East Asia were usually treated as *A. caesarea* (Scop.: Fr.) Pers. However, *A. caesarea* from Europe usually has a much fleshier, hardly striate pileus without umbo, and proportionally shorter stipe. Critical studies of *A. caesarea/hemibapha* group worldwide are needed (Yang, 1997: 67).

Amanita incarnatifolia Z. L. Yang Fig. 5

Pileus ca. 1.5-4 cm in diam., convex, sometimes umbonate, dark brown on disc, paler towards margin (greyish to brownish), glabrous, occasionally covered with white, felty to submembranous volval remnants; margin long striate [0.3-0.45R], non-appendiculate. Lamellae brownish when dried; lamellulae truncate. Stipe 3-5 × 0.3-0.5 cm, subcylindrical, without bulb. Volva 0.5-1 × 0.5-0.8 cm, saccate, white. Annulus pendant from 1-2 cm below apex of stipe. Spores (fig. 5) [50/3/1] (8.5-) 9.0-12.5 (-13.0) × 7.0-9.0 (-10.5) µm [Q = (1.12-) 1.19-1.43 (-1.46), **Q** = 1.30 ± 0.08], broadly ellipsoid to ellipsoid, rarely subglobose, inamyloid, colorless, hyaline, thin-walled, smooth. Volval remnants dominantly made up of filamentous hyphae 2-7 (-12) µm wide; inflated cells fairly abundant to locally abundant, ovoid to subglobose (35-60 × 30-45 µm) to ellipsoid (60-80 × 25-35 µm). Clamps abundant.

Specimen examined: Kiangsu: Ling-ku-sze woods, Nanking, 12. VII. 1936, K. L. Teng 2450 (IBN 5783, BPI 751069, as *A. spreta*).



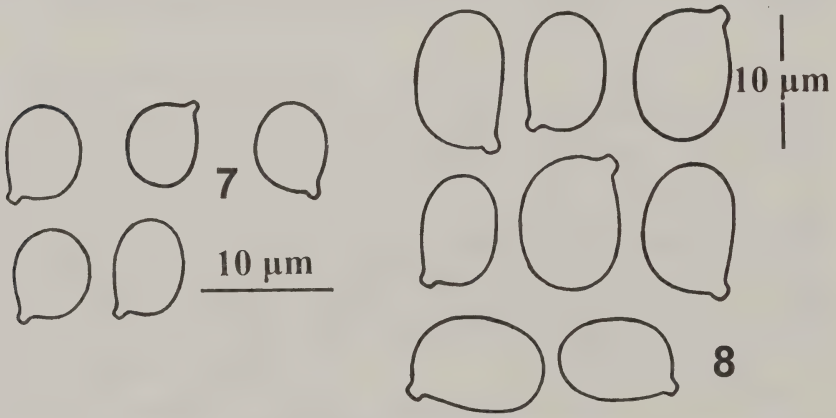
Figs. 5-6: Basidiospores of *A. incarnatifolia* (fig. 5, Teng 2450), and *A. spreta* (fig. 6, Singer *etc.*, *s.n.*).

Remarks: Teng 2450 was regarded as *A. spreta* (Peck) Sacc. (Teng, 1936: 554). *Amanita spreta*, originally described from North America, differs from *A. incarnatifolia* by the larger fruitbody with considerably shorter marginal striations, and significantly narrower spores (Fig. 6)

[Jenkins, 1986: 64; Tulloss *et al.*, 1995: 266; and my studies of *A. spreta* collections from USA: Massachusetts, Belmont, under pine in mixed woods, 7. IX. 1941, R. Singer *etc. s.n.* (FH[8]); shore of Walden Pond, under pine, birch *etc.*, 17. IX. 1947, Sarah Charter & R. Singer *s.n.* (FH)].

Amanita manginiana sensu Chiu Fig. 7

Pileus ca. 5 cm in diam., convex to applanate, ochraceous-brown, glabrous; margin nonstriate, often with white remnants of annulus. Lamellae free. Stipe 4.5 × 0.5-0.8 cm, subcylindrical; bulb ventricose to subfusiform, ca. 2 × 1.2 cm. Volva 0.5-1.5 cm high, limbate, membranous, dirty white. Annulus pendant from ca. 0.5 cm below apex of stipe, fragile. Spores (fig. 7) [55/2/2] (5.5-) 6.0-7.5 (-8.0) × (4.5-) 5.0-6.5 µm [Q = (1.08-) 1.11-1.40 (-1.42), **Q** = 1.23 ± 0.09], subglobose to broadly ellipsoid, sometimes ellipsoid, amyloid, colorless, hyaline, thin-walled, smooth. Volva on stipe base dominantly made up of filamentous hyphae 2-7 (-10) µm wide, hyaline, thin-walled (< 0.5 µm thick); inflated cells scattered to locally fairly abundant, subglobose to ellipsoid (40-75 × 30-50 µm) to clavate (45-80 × 25-50 µm) to fusiform (80-120 × 25-30 µm), hyaline, thin-walled, usually single, terminal or intercalary. Clamps lacking.



Figs. 7-8: Basidiospores of *A. manginiana* sensu Chiu (fig. 7, Shen 303-larger fruitbody), and *A. ovalispora* (fig. 8, Li 110).

Specimens examined: Kiangsu: Nanking, 28. VI. 1936, H. N. Shen 303-the larger fruitbody (IBN 5485, BPI 750771, as *A. phalloides*);

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[8] FH = Farlow Herbarium, Harvard University Herbaria, Boston, Massachusetts.

Ling-ku-sze woods, Nanking, 13. VI. 1937, S. C. Teng 2729 (IBN 7452, CUP-CH 1156, as *A. phalloides*).

Remarks: It appears that Shen 303, consisting of two fruitbodies, represents two closely related taxa: the larger fruitbody is *A. manginiana* sensu Chiu, and the smaller one is *A. pseudoporphyria* (see below). For comparison of these two taxa, see Yang (1997: 168), and Yang & Doi (1999: 126).

Teng (1936: 554) regarded Shen 303 as *A. phalloides* (Fr.) Link. *Amanita manginiana* sensu Chiu resembles *A. phalloides* from Europe in habit, but differs from the latter by its differently colored pileus, the presence of white annulus remnants on pileal margin; white, subapical, fragile annulus; ventricose to subfusiform bulb at the stipe base, and distinctly larger spores (see Yang 1997: 174; Breitenbach & Kränzlin, 1995: 152). Furthermore, inflated cells in the annulus of *A. manginiana* sensu Chiu are more abundant than in the annulus of *A. phalloides*.

Amanita aff. ***manginiana*** sensu Chiu or ***pseudoporphyria*** Hongo

Specimen examined: Kiangsu: Ling-ku-sze woods, Nanking, 14. VI. 1937, S. C. Li 180 (IBN 7482, CUP-CH 1162).

Remarks: Li 180 was identified by S. C. Teng as *A. phalloides*. This collection consists of two fruitbodies, both of which are immature. The general appearance of the dried specimen calls to mind both *A. manginiana* sensu Chiu and *A. pseudoporphyria*. Because the material is not in good condition, I couldn't study the anatomy of the volva. Without microscopic data it is very difficult to separate the two taxa.

Amanita ovalispora Boedijn Fig. 8

Pileus 4 cm in diam., convex, without umbo, brownish-grey, glabrous; margin long striate [0.4-0.6R], non-appendiculate. Lamellae brownish with greyish tinge when dried; lamellulae truncate. Stipe 7 × 0.5-0.8 cm, attenuate upwards, farinose to subfurfuraceous near apex, becoming subglabrous downwards, without bulb. Volva 2-2.5 × 1.5 cm, saccate, white to dirty white. Annulus lacking. Spores (fig. 8) [29/1/1] (8.0-) 8.5-10.0 (-13.0) × (5.5-) 6.0-7.5 μm [Q = (1.27-) 1.31-1.54 (-1.78), **Q** = 1.43 ± 0.11], ellipsoid, rarely broadly ellipsoid or elongate, inamyloid, colorless, hyaline, thin-walled, smooth. Volva on stipe base dominantly made up of filamentous hyphae 2-7 (-12) μm wide; inflated cells rare to scattered, but seemingly fairly abundant towards the inner surface, subglobose to broadly clavate to fusiform, 40-80 × 15-50 μm.

Specimen examined: Kiangsu: Sun Tomb, Nanking, 14. VII. 1936, S. C.

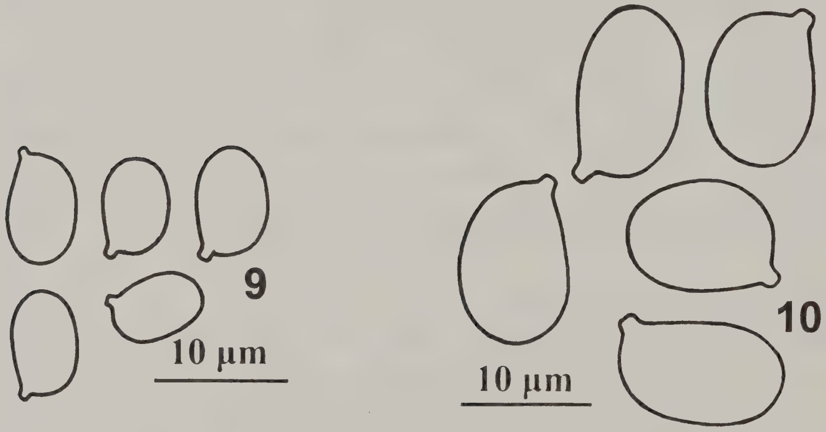
Li 110 (IBN 5808, BPI 751435, as *Amanitopsis vaginata*).

Remarks: *Amanita ovalispora* differs from *A. vaginata* (Bull.: Fr.) Lamarck by, among other features, the longer striations along the pileal margin and ellipsoid spores (Breitenbach & Kränzlin, 1995: 144; see also discussions under *Amanita* cf. *vaginata*).

Amanita pseudoporphyria Hongo Fig. 9

The habit of the only fruitbody is similar to that of *A. manginiana* sensu Chiu. Spores (fig. 9) [25/1/1] 7.0-9.0 × 5.0-6.0 µm [Q = 1.32-1.55 (-1.64), **Q** = 1.45 ± 0.09], ellipsoid, sometimes broadly ellipsoid, amyloid, colorless, hyaline, thin-walled, smooth. Volva on stipe base made up of fairly abundant to locally abundant, ellipsoid to fusiform (45-80 × 20-45 µm) to subovoid (40-60 × 25-45 µm) inflated cells, hyaline, thin-walled, single and terminal, sometimes intercalary; filamentous hyphae very abundant, 2-8 (-12) µm wide, hyaline, thin-walled; Clamps lacking.

Specimen examined: Kiangsu: Nanking, 28. VI. 1936, H. N. Shen 303-the smaller fruitbody (IBN 5485, BPI 750771, as *A. phalloides*).



Figs. 9-10: Basidiospores of *A. pseudoporphyria* (fig. 9, Shen 303-smaller fruitbody), and *Amanita* sp. (fig. 10, Li 275).

Remarks: Like *A. manginiana* sensu Chiu, *A. pseudoporphyria* was often wrongly treated as *A. phalloides* (Fr.) Link. However, *A. pseudoporphyria* differs from *A. phalloides* by its differently colored pileus; presence of white annulus remnants on the pileal margin; a white, subapical, fragile annulus; ventricose to subfusiform bulb at the stipe base; and distinctly narrower spores (see Yang 1997: 174; Breitenbach & Kränzlin, 1995: 152). In addition, there are more abundant inflated cells in the annulus of *A. pseudoporphyria* than in *A. phalloides*.

Amanita cf. ***vaginata*** (Bull.: Fr.) Lamarck
Pileus 5-7 cm in diam., convex to applanate, grey to grey-brown, glabrous, rarely covered with volval remnants; margin long striate [0.25-0.4R], non-appendiculate. Lamellae becoming brownish with grey tinge when dried. Stipe 6-13 × 0.8-1.5 cm, subcylindrical or slightly attenuate upwards, floccose to fibrillose, greyish, without bulb. Volva 2-4.5 × 1.5-2.5 cm, saccate, white. Annulus lacking. Spores [40/2/1] 10.0-12.0(-13.0) × 9.0-11.5 (-12.5) µm [Q = 1.0-1.11 (-1.17), **Q** = 1.06 ± 0.04], globose to subglobose, rarely broadly ellipsoid, inamyloid, colorless, hyaline, thin-walled, smooth. Volva from stipe base dominantly made up of filamentous hyphae 2-7 (-12) µm wide; inflated cells scattered to fairly abundant, subglobose to ovoid (40-90 × 40-60 µm) to ellipsoid to fusiform (40-100 × 25-40 µm), hyaline, thin-walled, single and terminal, occasionally intercalary; outer surface dominantly made up of filamentous hyphae, 2-7 µm wide, hyaline, sometimes with yellowish to brownish contents; inner surface gelatinized.
Specimen examined: Kiangsu: Ling-ku-sze woods, Nanking, 14. VI. 1937, S. C. Li 168 (IBN 7463, BPI 751472, CUP-CH 1157, as *Amanitopsis vaginata*).
Remarks: The name *A. vaginata* is frequently and widely used. Because no nomenclatural type is available for *A. vaginata* (Bull.: Fr.) Lamarck, its species concept is still unclear. Presently it is generally accepted that this species has a greyish to grey-brown pileus, a striate pileus margin, an exannulate stipe, a saccate, whitish, bitangent volva, and globose to subglobose spores measuring 9-13 (-14) µm (see Yang, 1997: 91).

Amanita virgineoides Bas
Pileus 5-10 cm in diam., convex to applanate, white, covered with white, conical to subconical, 1-2.5 mm high, volval remnants; margin non-striate, appendiculate. Stipe 9-13 × 1-2 cm, densely covered with white furfuraceous squamules; bulb subglobose, subfusiform to clavate, 1.5-3 cm wide, upper part covered with white, conical to subconical to furfuraceous volval remnants. Annulus apical to subapical, white, membranous, fragile. Spores [30/3/2] 7.5-9.0 (-10.0) × (5.0-) 5.5-6.5 (-7.0) µm [Q = (1.25-) 1.28-1.50 (-1.60), **Q** = 1.41 ± 0.09], broadly ellipsoid to ellipsoid, amyloid, colorless, hyaline, thin-walled, smooth. Septa often with clamps.
Specimens examined: Kiangsu: Nanking, 22. VI. 1932, S. C. Teng 951

(IBN 5503, BPI 751031 & 751059, CUP-CH 2144, as *A. solitaria*); Nanking, 12. VII. 1937, S. C. Li 278 (IBN *s.n.*, BPI 751045, CUP-CH 1960, as *A. solitaria*).

Remarks: Teng 951 was formerly regarded as *A. solitaria* (Bull.: Fr.) Mérat (Teng, 1932b: 27; Teng, 1936: 555). However, *A. solitaria*, originally described from Europe, differs from *A. virgineoides* by the dirty white, brownish to greyish volval remnants on the whitish, yellowish, greyish to brownish pileus; yellowish to greenish lamellae; a membranous annulus; ± reflexed squamules on the upper part of the enlarged stipe base, and larger spores [Bas, 1969; and my unpublished data based on collections made from Germany: Tübingen, 30. VII. 1996, Z. L. Yang D85 (HKAS 31460); 11. VIII. 1996, Z. L. Yang D112 (HKAS 31459)].

Amanita sp. Fig. 10

Pileus 4-8 cm in diam., convex to applanate, dark brown, dark reddish brown at center, becoming brown or paler towards margin, covered with brownish grey to grey-brown, felt-like to floccose, 3-7 mm wide, ca. 1-2 mm thick, volval remnants; margin striate [0.2-0.35R], non-appendiculate. Lamellae brown when dried; lamellulae truncate. Stipe 10-12 × 0.5-2 cm, slightly attenuate upwards, lower half of stipe often covered with randomly distributed, ± in belts arranged, brownish grey to grey-brown volval remnants; base without a bulb. Annulus lacking. Spores (fig. 10) [75/3/1] (10.0-) 10.5-13.0 (-14.0) × 7.0-8.5 (-9.0) µm [Q = (1.31-) 1.35-1.71 (-1.75), **Q** = 1.52 ± 0.11], ellipsoid to elongate, inamyloid, colorless, hyaline, thin-walled, smooth.

Specimen examined: Kiangsu: Ling-ku-sze woods, Nanking, 9. VII. 1937, S. C. Li 275 (IBN 7611, BPI 751347, CUP-CH 1959, as *Amanitopsis strangulata*)

Remarks: Teng (1936: 557) indicates that his *Amanitopsis strangulata* has globose spores, 9-11.5 µm in diam. Later he describes this taxon as having subglobose spores, measuring 10-13 × 9-10.5 µm (Teng 1939: 489; Teng, 1963; Teng, 1996: 451). I haven't studied Teng 486 & Shen 336, which are cited under *Amanitopsis strangulata* by Teng (1936: 557). However, it seems quite possible that there are at least two taxa in this group in China, one with globose to subglobose spores, and the other with ellipsoid to elongate spores. According to Bas (1984) *Amanitopsis strangulata* (Fr.) Roze (≡ *Agaricus strangulatus* Fr., 1838) is an unknown species, and *Agaricus strangulatus* sensu Fr. (1852) is a misapplied name for [*Agaricus*] *'Amanita' inaurata* Secr. which is not validly published. The correct name of *Amanita inaurata* Secr. is *A.*

ceciliae (Berk. & Br.) Bas. *Amanita ceciliae* differs from the present species by, among other features, the globose to subglobose spores (Corner & Bas, 1962: 300; Breitenbach & Kränzlin, 1995: 140). The present taxon is similar to *A. antillana* Dennis from Trinidad, and *A. beckeri* Huijsman from France. It differs from *A. antillana* by its darker pileus with grey-brown volval remnants, and narrower spores (see Tulloss, 1994: 309). It differs from *A. beckeri* by its differently colored pileus and volval remnants, and distinctly narrower spores (see Tulloss, 1994: 319).

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I am very grateful to Dr. R. E. Tulloss, New Jersey, for drawing my attention to the Chinese collections deposited in the USA, sending me on loan many valuable *Amanita* collections made from North America and Europe, and critically reading the manuscript. I thank Dr. A. Y. Rossman, Beltsville, and Prof. Dr. R. P. Korf, Cornell, very much for sending me on loan the above *Amanita* collections housed at their institutions. Prof. Dr. D. H. Pfister, Farlow Herbarium, Boston is sincerely acknowledged for allowing me accessing fungal specimens deposited in Farlow Herbarium, and using his laboratory to study the collections during my stay at Harvard University. I thank Dr. D. E. Boufford, Harvard University Herbaria, Boston very much for his kind arrangement, help and hospitality.

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LINDTNERIA LOWEI SP. NOV. (STEPHANOSPORALES, STEPHANOSPORACEAE)

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Abstract

Lindtneria lowei is described from the northeastern United States. It appears allied to *L. thujatsugina* and *L. pterospora.* Photomicrographs and scanning electron micrographs of basidiospores of *L. lowei* are provided.

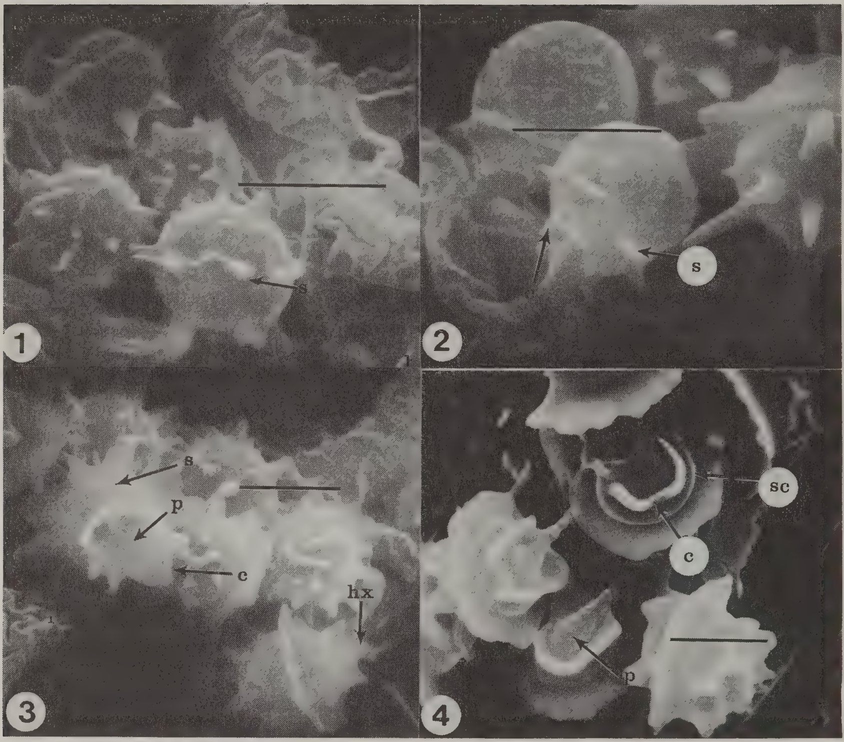
Key words: *Lindtneria lowei* sp. nov., Stephanosporales, taxonomy, *L. pterospora, L. thujatsugina*

Lindtneria lowei M. Lars. is described as a new species. Data on microscopic characteristics were obtained from small portions of the basidioma squash-mounted in 5% KOH and stained with 1% Phloxine B, lactophenol cotton blue (Johansen, 1940), or distilled water (H_2O). Melzer's reagent (Melzer, 1924) was used to detect amyloid or dextrinoid structures. Photomicrographs were prepared with the aid of an Olympus Vanox photomicroscope. Portions of the holotype, examined by scanning electron microscopy (SEM), were rehydrated in 10% KOH for 5 minutes, dehydrated sequentially in 24, 50, 75, and 95% ethyl alcohol for 5 minutes at each concentration, and 100% ethyl alcohol for two changes at 5 minutes each, lyophilized, and gold coated. Electron micrographs were taken with the aid of a Hitachi S530 scanning electron microscope at an accelerating voltage of 25 Kv. Terminology describing basidiospore morphology follows that of Pegler and Young (1971). Capital letters used to designate herbaria are those of Holmgren *et al.* (1990).

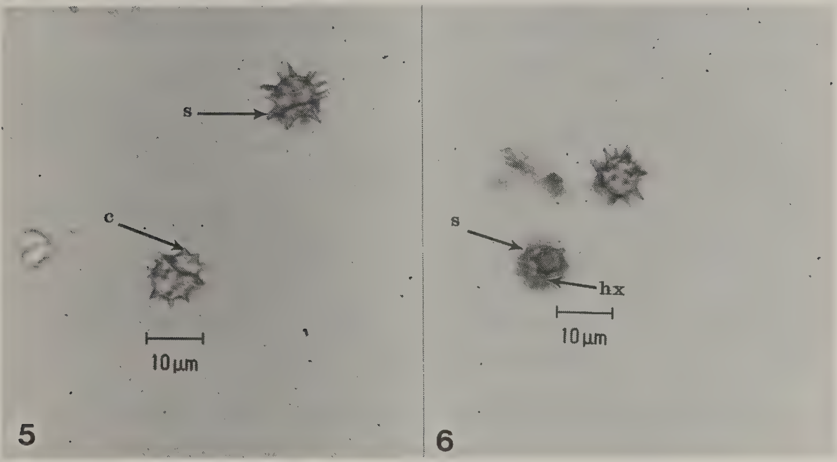
Lindtneria lowei M. Lars. *sp. nov.* Figs. 1-3, 5-6

Etymology--Named in honor of Dr. Josiah Lincoln Lowe for his lasting and extensive contributions to our knowledge of polypore fungi.

Basidiocarpo poro, pelliculo; hyphis septatis, fubulatis vel afibulatis; basidiis 40-50 x10-12(-15µm), sine contractis in medio; basidiosporis 6.5-7.5µm (aculeatis exclusis), aliquam collo circumnexo apiculum, secondario collo destituto; cystidiis vel cystidioliis absens.



Figs. 1-3. Scanning electron micrographs of *Lindtneria lowei* from holotype. Figs. 1 and 2 depicting early stages of formation of circumferential skirt (s) and corolla (c) (scale bar = 5µm). Fig. 3. Mature spores depicting skirt (s), plage (p), corolla (c), and hilar appendix (hx) (scale bar = 5µm). Fig.4. Scanning electron micrograph of *Lindtneria thujatsugina* from holotype depicting plage (p), corona (c), and secondary corona (sc) (scale bar = 6µm).


s
c
10µm
5
s
hx
10µm
6

Figs. 5-6. Photomicrographs of basidiospores of *Lindtneria lowei* from holotype depicting skirt (s), corolla (c) and hilar appendix (hx).

Holotypus - USA, New York, Tully, ad lignam *Populus* sp., legit J.L. Lowe (JLL 2628), 27 VIII 1944 (SYRF; isotypus BPI).

Basidioma annual, effuse, fragile, pelliculose; **hymenial surface** composed of irregular shallow pores up to .25 mm deep and 1.00-2.5 mm across, dull pinkish brown (near 5.0 YR 5/6); margin arachnoid, concolorous to paler than the hymenial surface; **cordons** barely visible at 10x.

Hyphal system monomitic: **subicular hyphae** 4-6 µm diam, frequently branching at right angles, some hyphal ends encrusted, faintly cyanophilous; **cordons** up to 40 µm across, branched, individual hyphae 2-2.5 µm diameter, some hyphae ampullate at septa with clamp connections and then 7.5-15 µm diameter; **basidia** 40-45 x 10-15 µm, broadly clavate when mature, without a median constriction, noticeably pluriguttulate, usually septate without clamp connections at the basal septa, 2-4 sterigmate, faintly cyanophilous; **basidiospores** 6.5-7.5 µm across (excluding aculei, the length of which are up to 2.5 µm), globose to subglobose, pale dull brown in KOH, Melzer's reagent, or distilled H_2O, aculeate, with a proximal submedial skirt that encircles the spore, plage area is encircled by a corona of which the hilar appendix is an integral part.

All parts faintly cyanophilous when immature and mature.

Discussion

Lindtneria lowei, known only from the nomenclatural type, is the third known species that produces basidiospores with a distinct corona surrounding the plage area and bearing a proximal submedial skirt that encircles the spore. *Lindtneria pterospora* Reid (Reid 1975)and *L. thujatsugina* M. Lars. (Larsen 1986) are similar in these basidiospore characters. However, *L. thujatsugina* produces a secondary corolla (see illustration, Fig. 4) while basidiospores of *L. pterospora* measure 7.5-8.5(-9) µm and are considerably larger than those of *L. lowei*. These three species may form a natural subgeneric group.

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LEPIOTACEAE OF FLORIDA, III. LEPIOTA S. STR., SECTION LEPIOTA

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ABSTRACT

Section *Lepiota* Singer contains species of *Lepiota* s. str. with fusiform basidiospores and a pileipellis in the form of a turf with long, thin pilocystidia, sometimes with an understory of much shorter, clavate elements. Two species occurring in Florida are here recognized in section *Lepiota*: *Lepiota clypeolaria* (Fr.) P. Kumm., and *Lepiota aspericeps* Murrill. This is the first account of the micromorphology of *L. aspericeps*, and the first sectional classification of this species.

INTRODUCTION

The genus *Lepiota* (Pers.) S.F. Gray sensu stricto has been noted for considerable variation in the form of the basidiospores among its species. Various authors have recognized three basic basidiospore shapes: ellipsoidal to ovoid; spurred or basally truncate ("bullet shaped"); and fusoid or fusiform (Sundberg 1967). The latter two spore shapes have generally been noted only in *Lepiota* s. str., whereas most of the lepiotaceous species that are usually placed in other segregate genera have basidiospores which display an ellipsoidal to ovoid shape, or some variation thereof.

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A number of authors have placed the species with fusiform basidiospores together in a single section. Bon (1981) placed these taxa in section *Clypeolariae* (Fr.) Quél. s. str., emend. Kühner (1936), excluding species with non-fusiform basidiospores. Singer (1986) recognized these species in section *Lepiota* Singer. Singer's arrangement has been followed by a majority of modern workers, including Enderle and Krieglsteiner (1989), Candusso and Lanzoni (1990), and Franco (1994). The reasons Singer proposed section *Lepiota* rather than accepting Kühner's emendation of section *Clypeolariae* are not known, but his arrangement is followed here because of its widespread acceptance in contemporary taxonomic treatments of *Lepiota* s. str.

In addition to basidiospore shape, species recognized here in section *Lepiota* have a pileipellis containing long, thin, subcylindric pilocystidia which are roughly erect in orientation, forming a loose turf. With expansion of the pileus, the apices of the pilocystidia often cohere, giving rise to fibrillose, hispid squamules. A sublayer of shorter, clavate elements can also occur. This type of pileipellis has been characterized as a palisade of more or less erect elements (Singer 1986), and as a trichodermium (Bon 1981, Franco 1994). It is similar in form to varieties of pileipellis noted for *Lepiota* s. str. in sections *Ovisporae* (J.E. Lange) Kühner, *Fuscovinaceae* Candusso and Lanzoni, *Stenosporae* (J.E. Lange) Kühner, and *Lilaceae* Bon (Bon 1981, Singer 1986, Candusso and Lanzoni 1990).

There are two species which occur in Florida that belong in section *Lepiota*: *Lepiota clypeolaria* (Fr.) P. Kumm., and *Lepiota aspericeps* Murrill. This article presents descriptions and illustrations of the morphology of these species as they occur there. This is the first account of the micromorphology of *L. aspericeps*, based upon study of the holotype and one other collection, and the first sectional classification of this species.

MATERIALS AND METHODS

The holotype of *Lepiota aspericeps* was borrowed from the FLAS mycological herbarium (University of Florida). *Lepiota clypeolaria* was determined from field and herbarium collections. Herbarium abbreviations used follow Holmgren et al. (1990).

Small tissue samples were excised, wetted in 95% ethanol, then revived in water. Sections were cut by hand and mounted in 3% KOH and Melzer's reagent, following standard mycological methods (Smith 1949; Largent et al. 1977; Singer 1986). Basidiospores were mounted in cresyl blue as well. Optical microscopy studies were carried out at 400 and 1000 X, and line drawings of micromorphological features were made using a

Leitz drawing tube. Sketches of basidiomata were executed freehand. Size ranges of basidiospores, basidia, cheilocystidia and pileipellis were based on ocular micrometer measurements of at least 12-15 elements of each type from each collection studied. Wall thickness of the basidiospores is illustrated in only one example for each species depicted. Colors noted in descriptions are personal interpretations, followed by references in parentheses to approximately equivalent centroid colors of the ISCC-NBS illustrated color name charts (Kelly and Judd 1965), in which the number cited is that of the color chip in the chart.

RESULTS

Lepiota clypeolaria (Fr.) P. Kumm., Der Führer in die Pilzekunde: 137 (1871)
= *Lepiota magnispora* Murrill, Mycologia 4: 237 (1912) Fig. 1

Macromorphological features: Pileus up to 3 cm broad, plano-convex to subexpanded, umbo indistinct, cuticle tomentose-fibrillose, cinnamon brown to bay (ISCC-NBS 56, 58), and disrupting with expansion of the pileus into fibrillose, repent to hispid squamules, concentrically arranged, the context whitish beneath; lamellae whitish to cream. Stipe up to 4.5 cm long, 1-2 mm in diameter, equal, whitish; partial veil whitish, floccose-fibrillose, not forming a distinct annulus but fragmenting into fragile, floccose, evanescent remnants distributed along the length of the stipe below a poorly defined annular zone, and easily lost with handling.

Micromorphological features: Basidiospores 11-15.5 (-18.7) x 4-6 (-6.7) µm (Q = 2.72); fusiform, smooth, hilar appendix sometimes inconspicuous, wall thick (0.5 µm), germ pore none; hyaline in KOH, dextrinoid (amber to medium orange brown in Melzer's reagent), not metachromatic. Basidia 20-30 x 5.7-10 µm; clavate, tetrasterigmate; basidioles 17-27.5 x 7-11.2 µm; all hymenial cells hyaline in KOH. Cheilocystidia 12-34 x 5-12.5 µm, clavate to ventricose to subcylindric, sometimes with pedicel, apices rounded, walls smooth, thin-sturdy, abundant, hyaline in KOH. Pleurocystidia lacking. Pileipellis a turf of long pilocystidia, up to 300 x 10-20 µm, more or less straight and erect, narrowly subcylindric, sometimes partly collapsing and falling over, apices rounded to collapsed or broken off, sometimes with a subapical constriction, borne upon pedicels of one or more shorter elements, often branched, mixed with shorter, clavate to ventricose elements forming an understory or sub-layer, pilocystidia and sub-layer elements with wall pigment amber to orange or reddish brown in KOH, reddish brown in Melzer's reagent, thickest at the base and thinning progressively toward the apex, walls sometimes thickened up to 0.5 µm, with internal protoplasm adhering to the inner surface, yellow in KOH and in

Melzer's reagent. Clamp connections present, occasionally at bases of basidia and cheilocystidia, often at bases of pilocystidia.

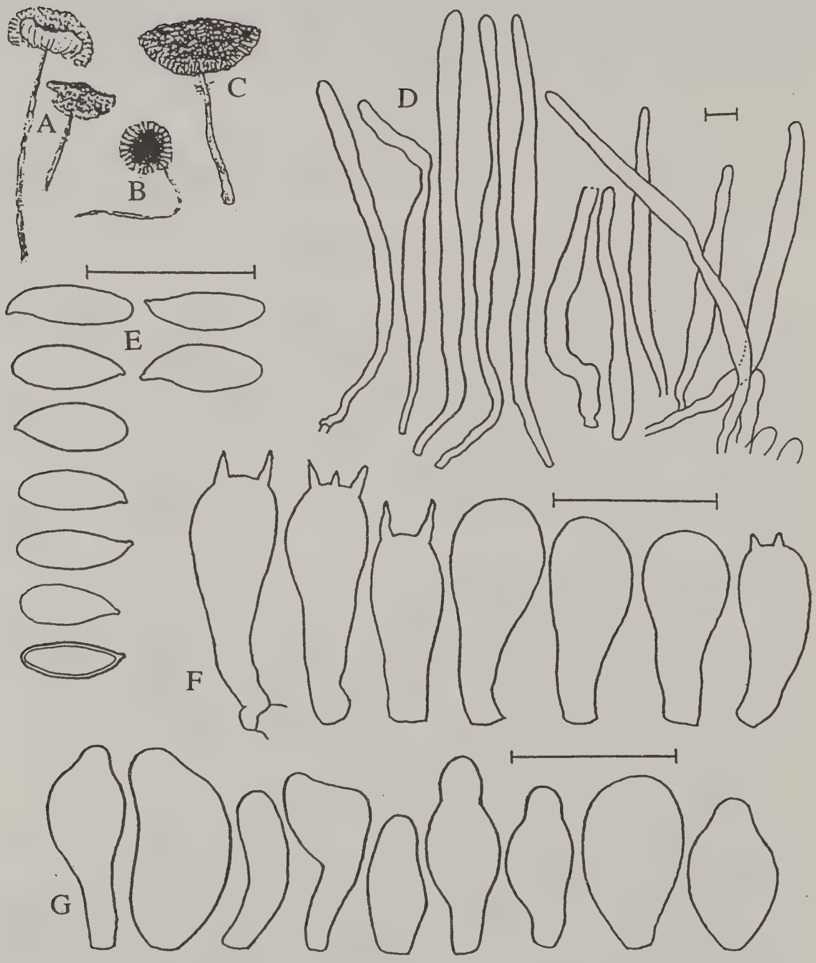

Fig. 1. *Lepiota clypeolaria* (Fr.) P. Kumm. A-C. Dried basidiomata. A. WJS VIII-26-77-B6. B. WJS VIII-27-77-11. C. FLAS F 21905. D. Pileipellis, WJS VIII-27-77-11. E. Basidiospores, WJS VIII-27-77-11. F. Basidia and basidioles, FLAS F 21905. G. Cheilocystidia, WJS VIII-27-77-11. Scale bars = 20 μm.

Collections studied: USA, FLORIDA. No information on locale or date of collection, *W.A. Murrill*, coll. and det., F 9680 (FLAS). USA, FLORIDA. Alachua County, Gainesville, ground in woods, 16 September 1932, *E. West* and *W.A. Murrill*, coll., *W.A. Murrill*, det., F 9686 (FLAS). USA, FLORIDA. Alachua County, Micanopy, on ground in woods, 17 July 1978, *R. Merkhofer*, coll. and det., F 52139 (FLAS). USA, FLORIDA. Alachua County, Gainesville, in sedge and rich humus under laurel oak, 31 July 1948, *W.A. Murrill*, coll. and det., F 21905 (FLAS). USA, FLORIDA. Alachua County, Hague, in humus under hardwoods, 7 August 1995, *B. Akers*, coll. and det., BPA 95-08-07-004 (SIU). USA, FLORIDA. Alachua County, 5 miles NW of Gainesville, solitary under hardwoods at Devil's Millhopper, 26 August 1977, *W.J. Sundberg*, coll. and det., WJS VIII-27-77-B6 (SIU). USA, FLORIDA. Alachua County, SW of Gainesville, Sugarfoot Hammock, 26 August 1977, *W.J. Sundberg*, coll. and det., WJS VIII-27-77-11 (SIU).

Comments. This is a variable and widely distributed species, often collected. Along with its fusiform spore and characteristic pileipellis, it is distinguished by its floccose-fibrillose partial veil, which often does not form a distinct annulus, but leaves delicate remnants spread along the length of the stipe below the poorly defined annular zone. This is an unusual and distinctive type of partial veil among lepiotaceous species. *Lepiota clypeolaria* has previously been reported from Florida by Murrill (1949), who stated that it was common in oak woods in the Gainesville area. *Lepiota magnispora* Murrill was originally described as a new species from the Pacific Coast area, (Murrill 1912), but Murrill later placed it in synonymy with *L. clypeolaria* (Kauffman 1925). Micromorphological data on the type of *Lepiota magnispora* were reported by H.V. Smith (1966). Color photographs of *L. clypeolaria* are presented in Breitenbach and Kränzlin (1995), Courtenay and Burdsall (1982), Dähncke and Dähncke (1979), Lincoff (1981), Miller (1972), Moser and Jülich (1985), Pacioni (1981), Phillips (1991), Pomerleau (1980), Seymour (1978) and States (1990).

Lepiota aspericeps Murrill, Mycologia 43: 236-237 (1951) Fig. 2

Macromorphological features: Pileus 1.5-3 cm broad, plano-convex, slightly umbonate, cuticle tomentose-fibrillose, rosy isabelline to bay, disrupting with expansion of the pileus into squarrose squamules composed of matted fibrils, concentrically arranged; lamellae whitish. Stipe up to 4.6 cm in length, 1-2 mm wide, whitish and more or less rufescent; partial veil membranous, well developed and forming a membranous annulus, sleeved below and flaring above, the margin thickened and bearing brownish patches, persistent but sometimes becoming detached from the stipe.

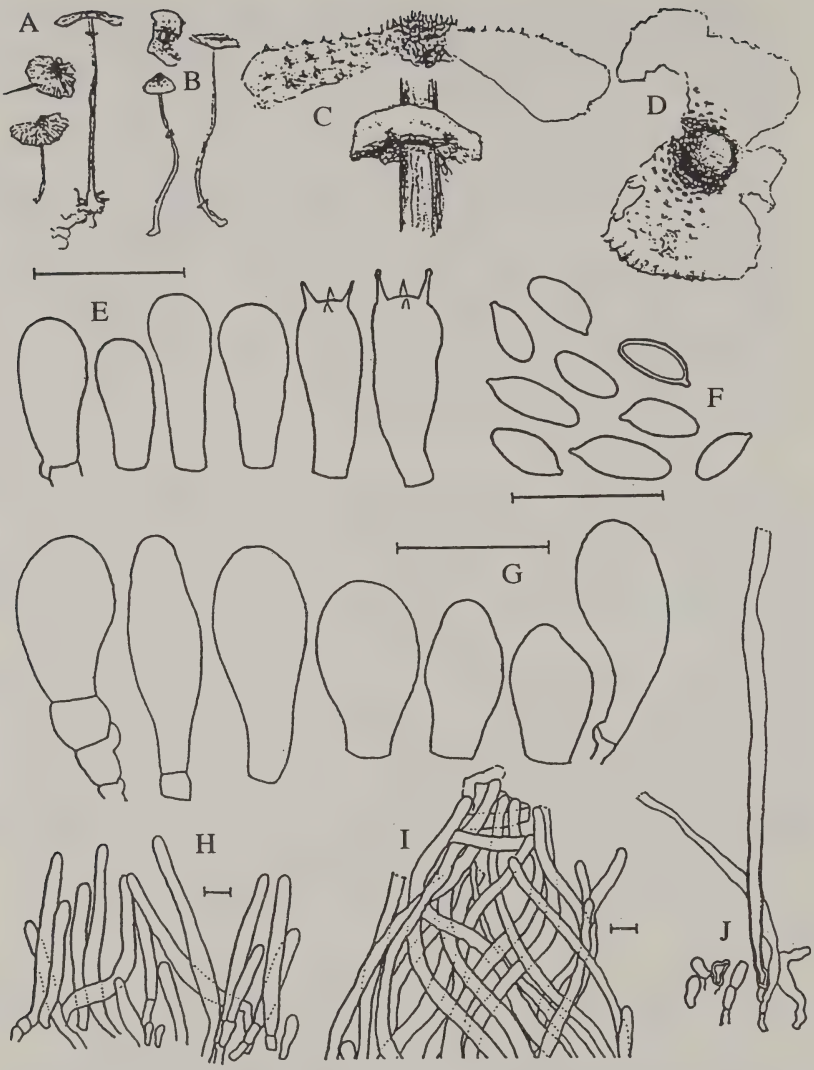

Fig. 2. *Lepiota aspericeps* Murrill. A.-B. Dried basidiomata. A. FLAS F 10447 (holotype). B. WJS VIII-10-85-A3. C. Enlargement of holotype showing hispid squamules of pileus (above) and membranous annulus (below). D. Enlargement of WJS VIII-10-85-A3. E. Basidia and basidioles, holotype. F. Basidiospores, holotype. G. Cheilocystidia, holotype. H.-J. Pileipellis. H. WJS VIII-10-85-A3. I. Fine structure of hispid squamule, holotype. J. Long and short elements including some with thickened walls, holotype. Scale bars = 20 µm.

Micromorphological features: Basidiospores 8.2-13 x 4.1-5.2 (-5.5) µm (Q = 2.10); subfusiform to narrowly ovoid, smooth, hilar appendix fairly prominent, wall thick (0.5 µm), germ pore none; hyaline in KOH, dextrinoid (amber to reddish brown in Melzer's reagent), variably metachromatic. Basidia (18-) 23.5-28.6 x (8.1-) 8.4-9 µm; clavate, tetrasterigmate; basidioles 17-23 x 7.7-9.5 µm; all hymenial cells hyaline in KOH. Cheilocystidia 18-33 x (7.5-) 9.6-15 µm, abundant, clavate to ventricose, often with pedicel of one or more short elements; walls smooth, thin-sturdy; hyaline in KOH. Pleurocystidia lacking. Pileipellis a turf of long pilocystidia, up to 172 (-300) µm long, 10-20 µm wide, more or less straight and erect, narrowly subcylindric, sometimes partly collapsing and falling over or with apices broken off, apices rounded, cohering to form hispid-fibrillose squamules, borne on pedicels of one or more shorter elements, often branching, occasionally with walls encrusted; sub-layer present with elements clavate to irregular, 18-43 x 7.5-10 µm; all elements of pileipellis slightly yellow in KOH, walls sometimes thickened up to 0.5 µm and then deeper yellow in KOH, yellow in Melzer's reagent, thickened walls of pilocystidia gradually thinning towards apex. Clamp connections present, occasionally at bases of basidia and pilocystidia, more often at bases of cheilocystidia.

Collections studied: USA, FLORIDA. Alachua County, Gainesville, ground in high hammock, 25 September 1944, W.A. Murrill, coll. and det., F 10447 (FLAS, holotype). USA, FLORIDA. Alachua County, Gainesville, gregarious under hardwoods in leaf litter, 10 August 1985, *W.J. Sundberg*, coll. and det., WJS VIII-10-85-A3 (SIU).

Comments. This is a seemingly rare species, known only from the two collections studied. The description of the species was based solely upon the type collection (Murrill 1951). The membranous partial veil, giving rise to a well-formed, persistent, detachable annulus, is unusual for species in *Lepiota* s. str., as is the metachromasy observed in the basidiospores. However, the form of the pileipellis and presence of distinct clamp connections, together with the nonporate, subfusiform spore warrant placement of this species within section *Lepiota*. *Lepiota aspericeps* is essentially similar to *L. clypeolaria* in its macroscopic appearance, but differs in having a partial veil that is distinctly membranous in form rather than floccose-fibrillose.

DISCUSSION

The species presented here, like various other species in section *Lepiota*, are not well understood taxonomically. A number of other species of *Lepiota* s. str. with fusiform spores and a comparable type of pileipellis have been described, but the morphological distinctions between them are not well defined. Important characters which vary among the species described include morphology of the partial veil, relative stature of the basidiomata, size and length/width ratio of the basidiospores, and presence or absence of cheilocystidia and clamp connections. Further work is needed to clarify species concepts and boundaries in this section, and among the lepiotaceous fungi in general.

ACKNOWLEDGMENTS

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MYCOTAXON

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NOTES ON HYPHOMYCETES. LXXVII. A NEW SPECIES OF RAMICHLORIDIUM, R. BACILLISPORUM, OCCURRING ON LEAF GLANDS OF CRATAEGUS FLAVA IN ALABAMA

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ABSTRACT

A new species of *Ramichloridium* de Hoog, *R. bacillisporum* Baker & Partridge, is described from a collection made on leaf glands of *Crataegus flava* Ait., in Alabama. It is readily distinguishable from previously described species by its bacilliform conidial shape. Some commentary is made on the similarity between *Ramichloridium* and species of *Veronaea* Ciferri & Montemartini.

INTRODUCTION

During the course of collecting foliicolous, disease-inducing hyphomycetous anamorphs on various phanerogamic hosts in Alabama, a distinct, hitherto unknown species of *Ramichloridium* has been encountered. It occupies an uniquely fastidious ecological niche, being associated with glands situated at the periphery of living leaves of a commonly-occurring hawthorn in xeric woodland habitats throughout the southeastern United States. It is herein described and illustrated.

The genus *Ramichloridium* de Hoog was established to accommodate a number of dematiaceous Hyphomycetes possessing sympodial conidiogenous cells bearing small, narrow, somewhat protuberant, unpigmented or slightly pigmented conidial scars and mostly one-celled, hyaline to subhyaline conidia (de Hoog, 1977). Within the concept of the genus several taxa previously classified in *Veronaea* Ciferri & Montemartini by Ellis (1976) were included. Stahel (1937) had originally coined the generic name *Ramichloridium* but this was invalidly published through lack of a Latin diagnosis. The binomial of its type species, *Ramichloridium musae* Stahel, was similarly invalid for the same reason. This author had, in fact, published two binomials for an identical entity, namely *Chloridium musae* Stahel and *R. musae*, on consecutive pages of the same publication. Ellis (1967, 1976) perpetuated the use of two names for the same fungus when he took up the specific epithet *musae* from *R. musae* for *Periconiella musae* M.B. Ellis and the same epithet from *C. musae* for *Veronaea musae* M.B. Ellis. All these names are now synonyms of *Ramichloridium musae* (M.B. Ellis) de Hoog [basionym = *Periconiella musae*] (de Hoog, loc. cit.).

The anamorphic fungus now known as *R. musae* was originally encountered as the causal organism of banana leaf speckle in Surinam (Stahel, loc. cit.). The application of two binomials to this fungus was, interestingly, predicated upon the presence of differing morphological manifestations; specifically, an unbranched form, to which the name *Chloridium musae* was applied, and a branched condition, for which *Ramichloridium musae* was proposed. In essence, the generic name *Ramichloridium* was established for what Stahel (loc. cit.) referred to as a "ramified *Chloridium*". The author was, of course, unaware of the fact that conidium ontogeny in both the taxa which he described is entirely different from that in the type species of *Chloridium* Link, *C. virescens* (Pers.) W. Gams & Hol.-Jech., which possesses a phialidic conidiogenous cell.

De Hoog (loc. cit.), when proposing the genus *Ramichloridium*, adopted another entity, namely *Chloridium apiculatum* Miller, Giddens & Foster [as *Ramichloridium apiculatum* (Miller, Giddens & Foster) de Hoog] as its type species. A statement to the effect that this taxon represented the "centre of the group" was made to justify its selection rather than the maintenance of *R. musae* in the sense that Stahel (loc. cit.) had originally conceived the genus. Although the reasons for this choice were not fully explained, it should be noted that because the conidiophores of *R. musae*, which arise orthotropically from prostrate hyphae, are often more or less verticillately branched, they are morphologically unlike those of most other taxa classified in the genus. Given that members of the genus as conceived by de Hoog (loc. cit.) have predominantly unbranched conidiophores, it is, perhaps, ironic that the generic name *Ramichloridium*, with its etymology referring specifically to a branched condition, should have been perpetuated. *Ramichloridium apiculatum*, which was originally isolated from forest soil in Georgia, U.S.A., but has subsequently been encountered worldwide on a variety of substrates, particularly decaying leaves, possesses unbranched conidiophores which distally bear slightly prominent, colorless or faintly pigmented scars and pale brown, verruculose conidia.

TAXONOMIC PART

Ramichloridium bacillisporum Baker et Partridge sp. nov. (Figure 1)

Coloniae glandibus tegentes, pilosae, pallide brunneae vel brunneae, densae. Mycelium partim superficiale, partim immersum, ex hyphis ramosis, septatis, pallide brunneis vel brunneis, laevibus, 2-2.5μm crassis compositum. Conidiophora macronemata, mononemata vel laxe caespitosa, holoblastica, indeterminata, ex lateribus hypharum et ex cellula isodiametrica oriunda, erecta, recta vel flexuosa, leniter attenuata, plerumque monoseptata, interdum ramosa, laevia, pallide flavo-brunnea, apicem versus pallidiora, usque ad 45μm longa, ad basim 5μm lata, ad apicem 3μm lata. Cellulae conidiogenae polyblasticae, in conidiophoris incorporatae, terminales, vel raro discretae, sympodiales, cicatricibus. Conidia solitaria, sicca, acropleurogena, bacilliforma, ad apicem obtusa, ad basim minusve truncata, unicellula, laevia, hyalina vel subhyalina, 14-17 × 2-3μm.

In glandibus folis vivis *Crataegi flavae*, Tuskegee National Forest, Macon County, Alabama, U.S.A., 27 July 1999, E. Christopher Partridge, AUA, holotypus.

Colonies concentrated and localized on glands at leaf margins, hairy, light brown to brown, dense. Mycelium partly superficial, partly immersed, composed of branched, septate, pale brown to brown, smooth, 2-2.5μm wide hyphae. Hyphal elements often interweaving to form a thin subiculum exogenously over the gland surface. Conidiophores macronematous, mononematous or loosely caespitose, holoblastic, indeterminate, arising laterally from the hyphae or from small clusters of somewhat isodiametric cells, erect, straight or somewhat flexuous, gradually attenuate, usually one-septate, occasionally branched a small distance above the base, smooth, mid to pale yellowish-brown, paler distally, somewhat thick-walled, with few to many small, flat, but readily discernible, somewhat pigmented, conidial scars occurring predominantly over the upper third, up to 45μm long, 5μm wide at the base, tapering to 3μm wide toward the apex. Conidiogenous cells polyblastic, incorporated in the conidiophore, terminal, or rarely discrete as a lateral branch, sympodial. Conidia solitary, dry, acropleurogenous, bacilliform, obtuse at the apex, subtruncate at the base, unicellular, smooth, hyaline to sub-hyaline, with the protoplast retracting at each end and sometimes cleaving centrally to create a false impression of septation, 14-17 × 2-3μm.

On glands of living leaves of *Crataegus flava* Ait., Tuskegee National Forest, Macon County, Alabama, U.S.A., 27 July 1999, E. Christopher Partridge, AUA, holotype.

DISCUSSION

The main distinction between species of *Ramichloridium* and *Veronaea* remains somewhat obscure, if not tenebrous. In describing the conidiophores of *Ramichloridium* as being apically denticulate or having scattered conidium-bearing denticles, de Hoog (loc. cit.) did not accurately document the true appearance of the conidiogenous loci. Although the scars are generally somewhat protuberant and readily discernible, they are not dissimilar to those of *Veronaea* except in their narrower width and a lesser degree of pigmentation. Conidiophores of *Ramichloridium* do not form denticles in the sense in which the term has customarily and traditionally been defined and applied when describing Hyphomycetes; that is, for small but distinctly tooth-like projections on which conidia are borne. The conidiogenous cells are certainly not denticulate in the manner exemplified by those occurring in a genus such as *Dactylaria* Saccardo. Moreover, it should be noted that true so-called denticulate conidiophores do not normally bear thickened conidial scars. By describing the conidiophores of *Ramichloridium* as being, in general, denticulate, the term is, in our opinion, being to some degree compromised by too loose an application. Only one species of *Ramichloridium*, namely *R. obovoideum* (Matsushima) de Hoog, possesses conidiophores in which the conidium-bearing periclinal wall projections approximate a condition which could be referred to as being denticulate. In the case of the conidia, those of *Veronaea* differ from those of *Ramichloridium* only in having a slightly broader, truncate base. Essentially, a state approaching a morphological continuum exists between these two genera. The distinction between *Ramichloridium musae* and species of *Periconiella* Saccardo is also somewhat tenuous, the latter being different in having a greater degree of overall conidiophore robustness, broader conidial scars, and, in most instances, generally thicker-walled conidia.

Ramichloridium bacillisporum possesses characteristics which are typical of *Ramichloridium* sect. *pallescens* de Hoog and bears some similarity to such species as *R. meliolae* (Hansf.) de Hoog and *R. subulatum* de Hoog. It is, however, clearly distinct from any species of *Ramichloridium* previously described in the shape and dimensions, particularly length, of its conidia.

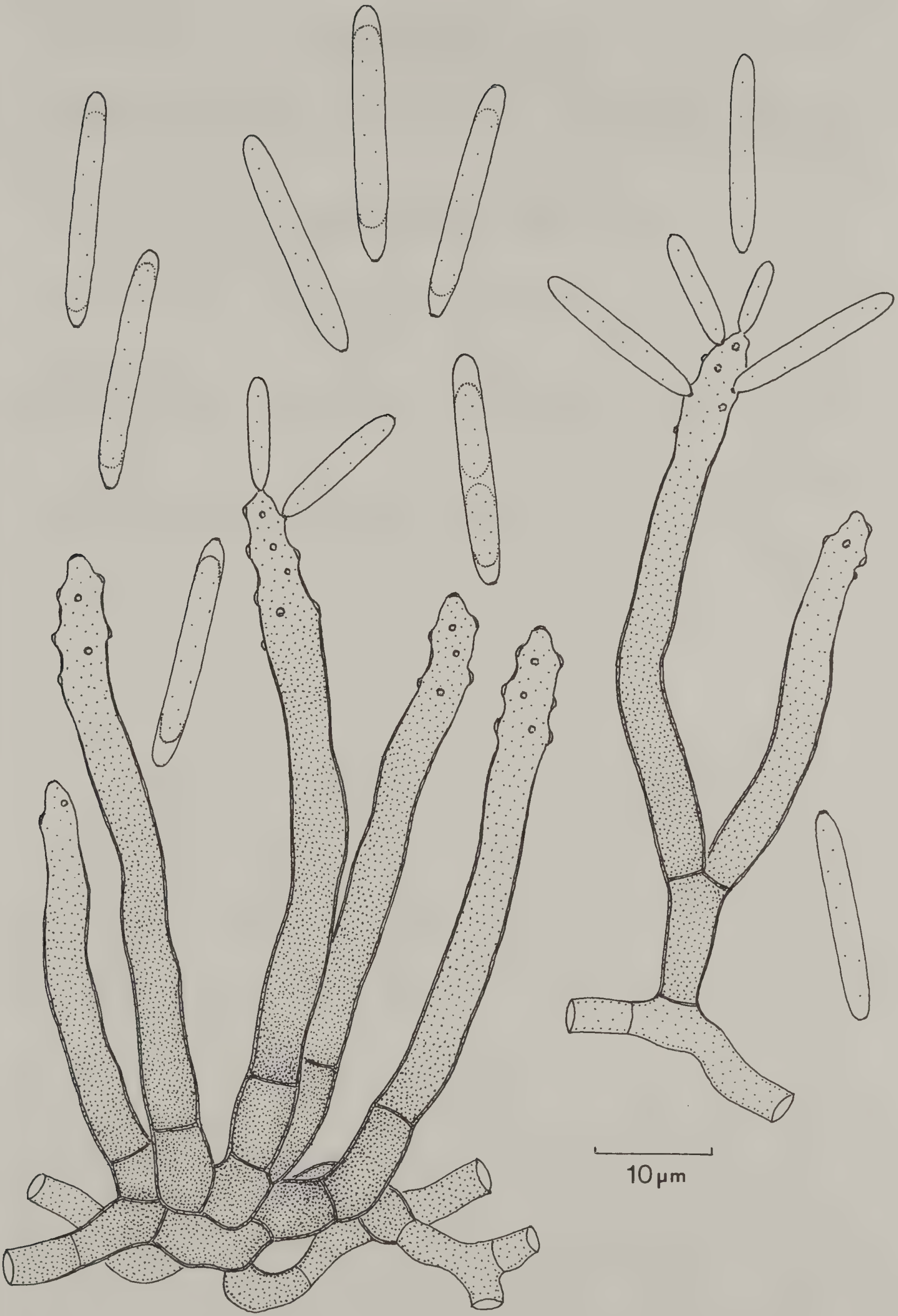

FIGURE 1. *Ramichloridium bacillisporum*. Conidiophores and conidia.

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MYCOTAXON

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NEW SEQUESTRATE ASCOMYCOTA AND BASIDIOMYCOTA COVERED BY THE NORTHWEST FOREST PLAN

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ABSTRACT

One new genus and 11 new species of sequestrate fungi are described from late successional forests in the range of the northern spotted owl: *Fevansia aurantiaca* gen. & sp. nov., *Gastroboletus vividus, Gastrosuillus umbrinus, Gymnomyces abietis, G. nondistincta, Hydnotrya inordinata, H. subnix, Octavianina cyanescens, Rhizopogon ellipsosporus, Thaxterogaster pavelekii* and *Tuber pacificum.* These are listed in the Northwest Forest Plan as rare.

Keywords: sequestrate fungi, hypogeous fungi, ectomycorrhizae, old-growth forests

INTRODUCTION

In development of the Northwest Forest Plan for preservation of the northern spotted owl (U. S. Department of Agriculture *et al.,* 1994), macrofungi associated with late successional forests were evaluated with special emphasis on long-term viability of populations. Numerous species were identified as needing special protection, including 27 collections of sequestrate fungi that preliminary examination suggested to be undescribed. Subsequent study of these collections revealed some to be previously described species and some to be conspecific with one or another of the tentatively undescribed species. Table 1 reconciles the names of all sequestrate fungus collections tentatively listed as new species in Table C3 of the Record of Decision (U. S. Department

Table 1. List of species name used in Table C3 from the Record of Decision and the currently accepted name. New species described in this paper are in boldface.

ROD Name	Currently Accepted Name
Alpova sp. nov. #Trappe 1966	***Fevansia aurantiaca*** Trappe & Castellano
Alpova sp. nov. #Trappe 9730	***Rhizopogon ellipsosporus*** Trappe, Castellano & Amaranthus
Arcangeliella sp. nov. #Trappe 12359	*Arcangeliella camphorata* (Singer & Smith) Pegler & Young
Arcangeliella sp. nov. #Trappe 12382	*A. camphorata*
Chamonixia sp. nov. #Trappe 12768	*Chamonixia caespitosa* Rolland
Elasmomyces sp. nov. #Trappe 1038	*Martellia maculata* Singer & A. H. Smith
Gastroboletus sp. nov. #Trappe 2897	***Gastroboletus vividus*** Trappe & Castellano
Gastroboletus sp. nov. #Trappe 7515	***G. vividus***
Gastrosuillus sp. nov. #Trappe 7516	***Gastrosuillus umbrinus*** Trappe & Castellano
Gastrosuillus sp. nov. #Trappe 9608	*Gastrosuillus amaranthii* Thiers
Gymnomyces sp. nov. #Trappe 1690	***Gymnomyces abietis*** Trappe & Castellano
Gymnomyces sp. nov. #Trappe 1706	***G. abietis***
Gymnomyces sp. nov. #Trappe 1710	***G. abietis***
Gymnomyces sp. nov. #Trappe 4703	***G. abietis***
Gymnomyces sp. nov. #Trappe 5052	***G. abietis***
Gymnomyces sp. nov. #Trappe 5576	***G. abietis***
Gymnomyces sp. nov. #Trappe 7545	***G. abietis***
Hydnotrya sp. nov. #Trappe 787	***Hydnotrya inordinata*** Trappe & Castellano
Hydnotrya sp. nov. #Trappe 792	***H. inordinata***
Hydnotrya subnix sp. nov. #Trappe 1861	***Hydnotrya subnix*** Trappe & Castellano
Martellia sp. nov. #Trappe 311	***G. abietis***
Martellia sp. nov. #Trappe 649	***Gymnomyces nondistincta*** Trappe & Castellano
Martellia sp. nov. #Trappe 1700	*Martellia fragrans* A. H. Smith
Martellia sp. nov. #Trappe 5903	***G. abietis***
Octavianina sp. nov. #Trappe 7502	***Octavianina cyanescens*** Trappe & Castellano
Rhizopogon sp. nov. #Trappe 1692	*Rhizopogon parksii* Smith
Rhizopogon sp. nov. #Trappe 1698	*R. parksii*
Rhizopogon sp. nov. #Trappe 9432	*Rhizopogon chamaleontinus* A. H. Smith

Thaxterogaster sp. nov. 4867	***Thaxterogaster pavelekii*** Trappe, Castellano & Rawlinson
Thaxterogaster sp. nov. 6242	***T. pavelekii***
Thaxterogaster sp. nov. 7427	***T. pavelekii***
Thaxterogaster sp. nov. 7962	***T. pavelekii***
Thaxterogaster sp. nov. 8520	***T. pavelekii***
Tuber sp. nov. #Trappe 2302	*Tuber asa* Tulasne & Tulasne
Tuber sp. nov. #Trappe 12493	***Tuber pacificum*** Trappe, Castellano & Bushnell

of Agriculture *et al.,* 1994) with the final determinations from subsequent, detailed study. We here describe the resulting new species as indicated in the second column of Table 1.

METHODS

Methods of collecting and macroscopic and microscopic study were generally those of Castellano *et al.* (1989). Colors of fresh specimens are in general terms. Hand-cut sections of both fresh and dried material were mounted in water, 5% KOH, Melzer's reagent, or cotton blue for standard light microscopy. Measurements of structures are from mature specimens. Spores were measured in water mounts, because other reagents may cause spores to either shrink or swell (N. S. Weber, personal communication). Other structures were measured in KOH mounts. Photomicrographs are from material mounted in 5% KOH or from thin sections stained with safranin and fast green. Ascomatal types are according to Weber *et al.* (1997). All specimens are deposited in the Mycological Herbarium of Oregon State University (OSC).

TAXONOMY

Fevansia aurantiaca Trappe & Castellano, gen. et sp. nov. (Fig. 1)

Basidiomata hypogaea, 17-19 x 20-23 *mm, subglobosa lobata pallide brunneo-aurantia vel aurantio-brunnea. Gleba firma, humida, pallide armeniaca vel aurantio-brunnea, loculis rotundis, sporis repletis, venis sterilibus, aurantiis marmorata. Odor oleosus-frutus. Peridium* 100-200 *µm crassum, maturitate in* KOH *pigmento multo amorpho, aurantio vel flammeo. Trama glebae cellulis inflatis usque ad* 20 *µm in diam, quasi aspectu pseudoparenchymae, in KOH pigmento multo, amorpho, aurantio vel flammeo. Sporae* 10-13 x (3.5-) 4-5 *µm, fusoideae, laeves, hyalinae. Holotypus* Trappe 12463.

Basidiomata hypogeous, 17-19 x 20-23 mm, subglobose-lobed, pale brown-orange to orange-brown, with much adherent soil and debris; no attachment point evident. **Gleba** firm, moist, pale pink-orange to orange-brown, the color a combination of orange to orange-brown trama and pale yellow to pale brown-yellow spore masses filling the rounded locules 0.1-0.4 μm broad; columella lacking, but sterile veins 0.2-1 mm broad, concolorous with trama, meandering through gleba; glebal sections of dried, mature specimens with dark red-orange, glassy-resinous deposits. **Odor** strongly oily-fruity. **Taste** not recorded.

Peridium 100-200 μm thick. **Epicutis** ± 25 μm thick, of appressed, hyaline, thin-walled hyphae 1.5-4 μm in diam, the cell contents pale olive-yellow to orange. **Subcutis** 75-175 μm thick, of interwoven, hyaline, thin-walled hyphae 1.5-5 μm in diam at septa with occasional cells inflated to 5-10 μm, in youth with scattered, extracellular deposits of amorphous orange pigment in KOH, in Melzer's reagent the pigment dissolving into yellow to orange pigment globules, at maturity with massive extracellular deposits of orange to bright red pigment in KOH, in Melzer's reagent the pigment dissolving into orange to brown pigment globules. **Trama** with a narrow, central stratum of interwoven, hyaline, thin-walled hyphae 1.5-5 μm in diam, the broad zones between central strand and locule margins of hyaline, thin-walled hyphae with most cells inflated to 6-20 μm in diam to appear nearly pseudoparenchymatous, pigment deposits throughout as in the peridial subcutis; sterile veins structured similarly to tramal central strand. **Subhymenium** not found. **Hymenium** not found. **Basidia** not found. **Clamp connections** not found.

Spores 10-13 x (3.5-) 4-5 μm, fusoid, smooth, in KOH hyaline singly, in mass gray-yellow, with 2-3 large guttules, the walls 0.5 μm thick; in Melzer's reagent pale yellow singly, gray-yellow in mass; cyanophilic.

Etymology: The generic name, *Fevansia,* is in honor of the collector of the holotype, Frank Evans of the North American Truffling Society. The species name is Latin, *aurantiaca* (pale orange), in reference to the color of the glebal trama.

Distribution, habitat and season: Central Cascade Range of Oregon at 1,000-1,700 m

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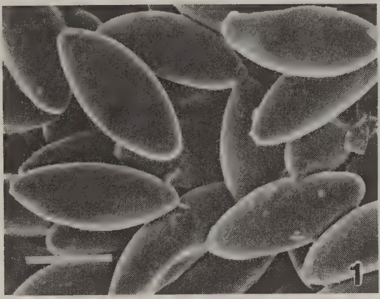
Figs. 1-6. Fig. 1. ***Fevansia aurantiaca*** basidiospores, bar = 6 μm. Fig. 2. SEM of basidiospores of ***Gastrosuillus umbrinus***, bar = 5 μm. Fig. 3 SEM of basidiospores of ***Gastroboletus vividus***, bar = 5 μm. Fig. 4. Sporocarps of ***G. umbrinus***, bar = 20 mm. Fig. 5. Interior cross-section of a sporocarp of ***G. vividus***, bar = 10 mm. Fig. 6. Exterior of a sporocarp of ***G. vividus***, bar = 10 mm.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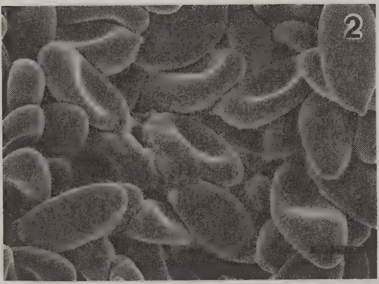
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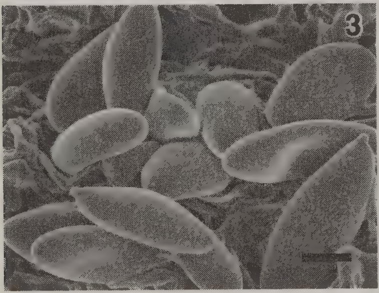
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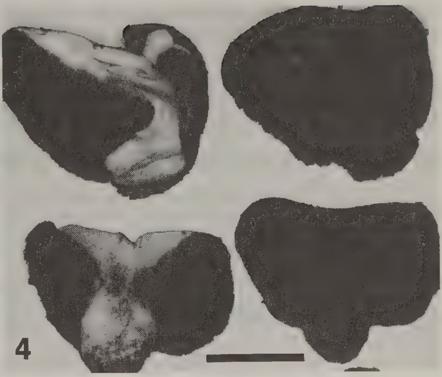
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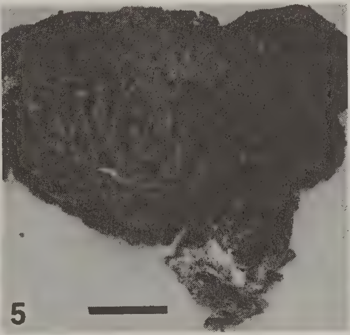
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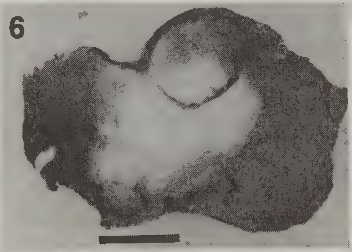
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elevation; hypogeous under mature coniferous forests, probably ectomycorrhizal with *Abies lasiocarpa, Pseudotsuga menziesii,* and other species of Pinaceae; August.

Collections examined: HOLOTYPE - Oregon: *Deschutes Co.,* Devil's Lake, F. Evans, Trappe 12463, 3 Aug. 1991 (OSC). **PARATYPE - Oregon:** *Linn Co.,* head of Hackleman Creek, J. Trappe 1966, 7 Aug. 1969 (OSC).

Discussion: The size and shape of the spores are reminiscent of the genera *Rhizopogon* and *Alpova* sect. *Rhizopogonella*, as monographed by Trappe (1975). However, *Fevansia* differs from these genera by its orange color when fresh, the large, inflated cells in the glebal trama, and the very pale color of the spores in mass.

Gastroboletus vividus Trappe & Castellano, sp. nov. (Figs. 3, 5 & 6)

Basidiomata hypogaea vel subhypogaea, 30-50 35-65 (-80) *mm, boletoidea. Pileus luteus areis rubris vel rubique e rubro suffusus, siccus coactus. Contaxtus luteolus, dilute rubescens ubi expositus. Tubi adnato-secedentes, non verticales, saepe contorti, olivacei, oroficiis initio vivide flavis, demum aurantiis vel sanguineis. Stipes* 20-30 x 10-30 *mm, apice rubro-furfuraceis, sub tubis abrupte bulbosus e vivide flavus vel sordide flavus. Sporae fusoideae, laevis,* (11-) 13-18 (-22) x 6-7 (-8) *μm, nonamyloideae. Holotypus* Trappe 2897.

Basidiomata hypogeous to subhypogeous, 30-50 x 35-65 (-80) mm, boletoid but with pileus margins strongly upturned at maturity, the cutis moderate yellow with red areas or red blushed overall, dry, felty; context pale yellow, very slowly staining pale red where exposed, with narrow, olive to red zones at tube attachment and immediately beneath the cutis. **Tubes** adnate-seceding, aligned from slightly below horizontal to nearly vertically upward, often contorted, 10-20 mm long, olive; mouths circular to ellipsoid and 0.5-2 mm broad, initially brilliant yellow but soon becoming olive and by maturity red-orange to dark red, not bluing where bruised. **Stipe** 20-30 x 10-30 mm, red-furfuraceous at apex, abruptly bulbous below tube layer and brilliant yellow to sordid yellow; context red at apex, pale yellow below, not changing color when exposed. Melzer's reagent non-reactive on fresh or dry context. **Odor** and **taste** not distinctive.

Pileus cutis a loose tangle of hyaline, thin-walled hyphae 4-8 μm in diam at septa, the cells mostly slightly inflated. **Context** of tightly interwoven, hyaline, thin-walled hyphae 3-8 μm in diam, the cells generally not or only slightly inflated, plus scattered to abundant oleiferous hyphae. **Stipe epicutis and context** of hyphae similar to that of pileus context but tending to be parallel and with scattered cells inflated up to

25 µm. **Tube trama** parallel, of hyaline, thin-walled hyphae 2-4 µm in diam at septa, most cells slightly inflated. **Subhymenium** of hyphae similar to those of trama but interwoven. **Basidia** clavate, 30-45 x 9-11 µm with (2-) 4 sterigmata 3-4 x 1 µm. **Cystidia** absent. **Clamp connections** absent.

Spores fusoid or occasionally obovoid, bilaterally symmetrical, smooth, (11-) 13-18 (-22) x 6-7 (-8) µm, the walls 0.5 µm thick, in KOH golden yellow singly and bright brown-yellow in mass, in Melzer's reagent pale yellow singly and brown-yellow in mass; cyanophilic.

Etymology: Latin, *vividus* (brightly colored), in reference to the bright yellow and red colors of the sporocarps.

Distribution, habitat and season: Southern Oregon Cascade Range and Siskiyou Mountains, south to the central Sierra Nevada at 1,700-2,350 m elevation; hypogeous to subhypogeous under mature *Abies concolor, A. magnifica* var. *shastensis, Pinus contorta* and *Tsuga mertensiana;* June through September.

Collections examined: HOLOTYPE - Oregon: *Jackson Co.,* Rogue River National Forest, Jackson Gap, J. Trappe 2897, 16 Sept. 1971 (OSC). **PARATYPES - Oregon:** *Klamath Co.,* Crater Lake National Park, Cleatwood picnic area, J. Trappe 7515, 29 Sept. 1983 (OSC). **California**: *Fresno Co.,* Sierra National Forest, Rock Creek Rd., J. Trappe 17827, 16 Aug. 1995 (OSC); same location, T. Lebel, Trappe 17988, 31 July 1996 (OSC); same location, J. Eberhart, Trappe 19141, 2 Aug. 1996 (OSC); *Shasta Co.,* Soda Lake, D. Showers 3679, 31 July 1976 (SFSU); near Kings Creek, D. Showers 3685, 9 August 1976 (SFSU); Lassen Volcanic National Park, Summit Lake, W.B. Cooke 50623, 8 September 1975 (SFSU); *Sierra Co.,* six miles south of Yuba Pass, H.D. Thiers 52703, 11 September 1989 (SFSU); *Siskiyou Co.,* Shasta-Trinity National Forest, Panther Creek-Squaw Valley Creek area, W.B. Cooke 53908, 21 October 1976 (SFSU).

Discussion: None of the heretofore known species of *Gastroboletus* described by Thiers & Trappe (1969) and Thiers (1989) show the vivid yellows and reds of fresh *G. vividus* except the somewhat less brightly colored *G. amyloideus* Thiers, which differs in having amyloid spores. The bright colors of *G. vividus* fade on drying, and then specimens resemble those of dried *G. turbinatus*. However, the dried context of G. turbinatus turns instantly black when Melzer's reagent is applied, whereas the dried context of *G. vividus* is nonreactive to Melzer's reagent.

Gastrosuillus umbrinus Trappe & Castellano, sp. nov. (Figs. 2 & 4)

Basidiomata hypogaea vel subhypogaea, 25-50 *mm lata, sordide umbrina, parce tomentosa. Tubi adnati vel decurrentes, verticales vel ultra horizontales, umbrini. Stipes* 10-20 x 7-15 *mm, ventricosus vel deorsum contractus, trans tubos vix protrudens, brunneolus vel brunneus, ubique punctis glandulosis, brunneis vel nigris. Sporae ellipsoideae,* 7-10 x (3-) 3.5-4 *µm, laevis, apiculo excentrico. Holotypus* Trappe 7516.

Basidiomata hypogeous to subhypogeous, 25-50 mm broad, boletoid, the pileus margins upturned, the cutis dark sordid brown with a sparse tomentum over a shiny-smooth surface; context brown-white to pale brown. **Tubes** adnate to decurrent, aligned from vertical to above horizontal, contorted and anastomosed, 8-17 mm long, brown-olive to dark brown, the mouths circular to ellipsoid, 0.5-2 mm broad, dark brown. **Stipe** 10-20 x 7-15 mm, ventricose or tapering downward, barely protruding below the tubes, pale brown to brown with brown to black glandular dots from apex to base, the context pale brown with brown patches especially near the apex. **Odor** pleasant. **Taste** not recorded.

Pileus cutis a loose tangle of hyaline, thin-walled hyphae 3-8 µm in diam at septa, many cells slightly inflated, the tissue obscured by abundant, extracellular, brown granules. **Context** of interwoven, hyaline, thin-walled hyphae 4-10 µm in diam at septa, most cells strongly inflated, with scattered, extracellular, brown granules. **Stipe cutis and context** of hyphae similar to that of pileus context but tending to be parallel. **Caulocystidia** clustered, obscured by dense deposits of amorphous pigment that is vinaceous in KOH mounts of fresh specimens, brown in long-dried specimens rehydrated in KOH. **Tube trama** parallel, of hyaline, thin-walled hyphae 1.5-3 µm in diam at septa, a few cells slightly inflated. **Subhymenium** of ± isodiametric cells 5-8 µm in diam. **Basidia** clavate, 18-28 (-35) x 7-9 µm, with (2-) 4 sterigmata. **Pleurocystidia** in clusters, hyaline, thin-walled, obtuse-cylindric, 60-90 x 6-9 µm, often with crystalline contents, the bases obscured by dense deposits of brown, amorphous material; single cystidia scattered in hymenium, hyaline, thin-walled, obtuse-cylindric, 25-35 x 6-8 µm.

Spores ellipsoid, the apiculus eccentric, smooth, thin-walled, 7-10 x (3-) 3.5-4 µm, in KOH pale yellow singly and brown-yellow in mass, in Melzer's reagent pale olive singly and pale olive-brown in mass; cyanophilic.

Etymology: Latin, *umbrinus* (deep brown), in reference to the overall deep brown color of the basidiomata.

Distribution, habitat and season: Known only from the type locality in the Klamath Mountains of northern California at ca 2,300 m elevation; hypogeous to subhypogeous under and probably ectomycorrhizal with mature *Pinus monticola;* September.

Collection examined: HOLOTYPE - California: *Siskiyou Co.,* Shasta-Trinity National Forest, Deadfall Meadows, west of Gazelle, M.A. Castellano, Trappe 7516, 30 Sept. 1983 (OSC).

Discussion: Basidiomata of the closely related *Gastrosuillus suilloides* (Thiers) Thiers have a generally brown aspect when fresh, but its tubes are green-yellow to olive-yellow in contrast to the dark brown tubes of *G. umbrinus,* and its stipe-columella is smaller and lacks the glandular dots common on *G. umbrinus.*

Gymnomyces abietis Trappe & Castellano, sp. nov. (Fig. 7)

Basidiomata hypogaea, 6-28 x 10-40 *mm, basi indentata, radiiatim rugosa, mycelio basali. Peridium separabiles, juventute tenue, album, pubescens, demum stramineum, interdum areis roseolis vel aurantio-brunneolis. Gleba sicca, juventute alba, demum pallide armeniaca, loculis labyrinthis* 0.5-3 x 0.1-0.5 *mm, pulvino basali, sterili, albi et venis sterilibus, tenuibus, nonnullis. Peridium* 100-200 *μm crassum. Expicutis trichodermium cellulae obtuso-cylindricae, clavatae vel versiformium. Sporae globosae, subglobosae vel late ellipsoideae,* 8-10 (-14) x (7-) 7.5-9.5 (-11) *μm sine ornamento, maturitate ornamenta virgae amyloidea* (0.3-) 1 (-1.5) x 0.3-1 *μm, saepe in lineis brevibus crassis junctae vel lineis amyloideis, angustis connexae in reticulo partiali vel prope completo. Holotypus* Trappe 7547.

Basidiomata hypogeous, 6-28 x 10-40 mm, the base indented, radially rugose, and with soil attached near basal mycelium. **Peridium** readily separable, in youth thin, white, pubescent, soon becoming smooth and the sides and upper surface dull, pale yellow, sometimes blushed rose to orange-brown areas, not staining where bruised or slowly becoming slightly brown, often rupturing to expose glebal locules as the basidioma expands. **Gleba** dry, white in youth, soon pale orange-yellow from spores lining the labyrinthiform locules 0.5-3 x 0.1-0.5 mm, with a white, small to prominent, basal pad of sterile tissue and occasional, narrow, white, sterile veins or a narrow, columnar to dendroid, white columella up to 6 x 0.5-3 mm. **Odor** and **taste** not distinctive.

Peridium 100-200 μm thick. **Epicutis** a loose to tightly packed trichodermium of obtuse-cylindric to clavate or occasionally versiform, hyaline, thin-walled end cells (2-) 3-5 μm in diam, this in age collapsing to appear appressed-interwoven, where ruptured often leaving a tangle of loose hyphae. **Subcutis** of interwoven, hyaline, thin-walled hyphae 2-5 µm in diam with scattered cells inflated up to 10 µm and occasional nests of sphaerocysts where subcutis and tramal intersections merge. **Trama** of subparallel, hyaline, thin-walled hyphae 2-5 µm in diam, at tramal junctions with occasional to many isolated cells inflated up to 25 µm and with occasional nests of sphaerocysts; basal pad or columella with abundant sphaerocysts. **Subhymenium** with 3-4 tiers of isodiametric cells, those nearest the central stratum of the trama up to 25 µm in diam, grading to those nearest the hymenium at 6-15 µm in diam. **Basidia** clavate, 23-29 (-40) x (6-) 8-13 (-15) µm, with 1-4 sterigmata ± 5 x 1 µm. **Cystidia** absent.

Spores globose to subglobose or broadly ellipsoid, 8-10 (-14) x (7-) 7.5-9.5 (-11) µm, hyaline, ornamented in youth by unevenly amyloid rods and inamyloid lines 0.5 x 0.2-0.5 µm, the rods sometimes loosely joined in short rows, by maturity the rods strongly and evenly amyloid, (0.3-) 1 (-1.5) x 0.3-1 µm, often joined to form short, thick lines or connected by narrow, low, amyloid lines on the spore surface to form a partial to or nearly complete reticulum; sterigmal appendage with a strongly amyloid, basal collar or a large, amyloid deposit on one side.

Etymology: Latin *abietis* (“of firs”), in reference to the regular association of the species with the true firs (genus *Abies*).

Distribution, habitat and season: Widely distributed across northern Sierra Mountains and Coast and Cascade Ranges of Oregon and Seven Devil’s Mountains of Idaho at ca. 1,100-2,800 m elevation; hypogeous under *Abies amabilis, A. concolor, A. grandis, A. lasiocarpa, A. magnifica* vars. *magnifica* & *shastensis, A. procera* and possibly *Tsuga mertensiana;* July through October.

Collections examined: HOLOTYPE - California: *Siskiyou Co.,* Klamath National Forest, Carter Meadows Summit, I. Ho, Trappe 7547, 1 Oct. 1983 (OSC). **PARATYPES – California:** *Fresno Co.,* Huntington Lake, H.D. Thiers 13406, 6 Oct. 1965 (OSC, SFSU). *Lassen Co.,* Lassen Volcanic National Park, Juniper Lake campground, W.B. Cooke 53066, 5 Oct. 1976 (OSC). *Madera Co.,* Devil's Postpile National Monument, near Soda Creek campground, H.D. Thiers 20919, 20920, 20923, 20928, 20935, 20939,

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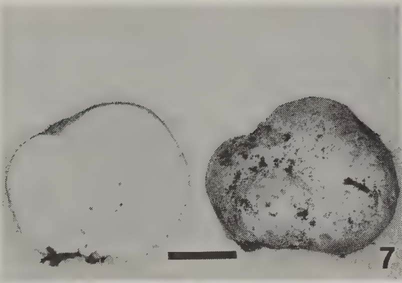
Figs. 7-11. Fig. 7. Sporocarp of ***Gymnomyces abietis***, bar = 3 mm. Fig. 8. SEM of basidiospores of ***Gymnomyces nondistincta***, bar = 3 µm. Fig. 9. Sporocarps of ***Hydnotrya inordinata***, bar = 10 mm. Fig. 10. SEM of ascospores of ***H. inordinata***, bar = 10 µm. Fig. 11. SEM of ascospores of ***H. inordinata***, bar = 10 µm.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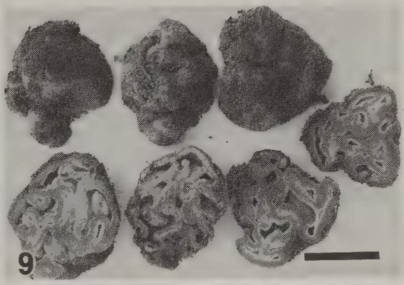
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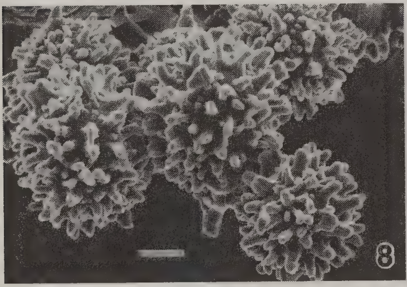
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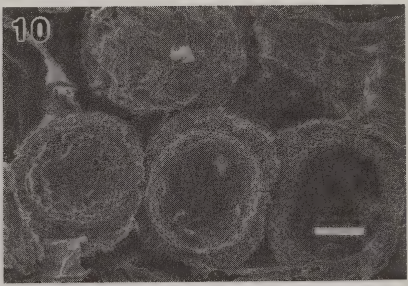
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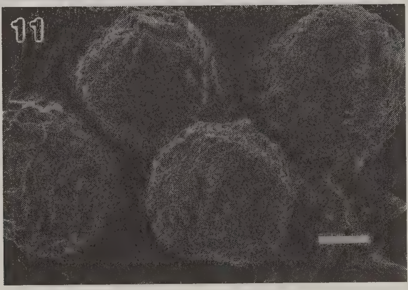
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20941, 20950, 10 Sept. 1967 (all SFSU, OSC). *Mariposa Co.,* Yosemite National Park, near Porcupine Flat, H.D. Thiers 21081, 14 Sept. 1967 (SFSU, OSC). *Mono Co.,* near Minaret Summit, H.D. Thiers 20971, 11 Sept. 1967 (OSC, SFSU); *Nevada Co.,* Yuba Pass, H.D. Thiers 21119-29 Sept. 1967 & 23646-2 Sept. 1969 (OSC, SFSU). *Plumas Co.,* Lassen National Forest, Swaine Mountain Experimental Forest, J. Waters, Trappe 16056-16 Aug. 1994, 16176-9 Sept. 1994, 16187-21 Aug. 1994, 16275, 26 July 1994, 16334-20 Aug. 1994, 16353-20 Aug. 1994, 16398-10 Sept. 1994 (OSC). *Siskiyou Co.,* Klamath National Forest, Carter Meadows Summit, M. Castellano, Trappe 7545, 1 Oct. 1983 (OSC); Marble Mountain Wilderness Area, Haypress Meadows, D. Largent 7223, 24 Oct. 1976 (HSC, OSC); Mount Shasta National Recreation Area, Wagon Camp, W.B. Cooke 54014, 23 Oct. 1976 (OSC). *Tehama Co.,* Mineral, W.B. Cooke 50536, 6 Sept. 1975 (OSC). *Tuolumne Co.,* Pinecrest, H.D. Thiers 13892 & 13904-28 Oct. 1965; 21281, 22 Oct. 1967 (OSC, SFSU); Yosemite National Park, Tuolumne Meadows, H.D. Thiers 21070, 13 Sept. 1967 (OSC, SFSU). **Idaho:** Adams Co., Hell's Canyon, Kinney Point, A.H. Smith 60297, 60298 & 60329, 20 Aug. 1958 (MI, OSC). **Oregon:** *Benton Co.*, Mary's Peak, near summit, J. Trappe 4703, 22 Sept. 1976 & Trappe 5576, 18 Sept. 1970 (OSC). *Clackamas Co.*, Mount Hood National Forest, Phlox Point, J. Trappe 311-16 Sept. 1965 & 5052-9 Sept. 1977 (OSC). *Deschutes Co.,* Deschutes National Forest, South Sister summit trail, K. Kittridge, J. Trappe 13385 (OSC); *Jefferson Co.,* Deschutes National Forest, Mount Jefferson Wilderness Area, Shirley Lake, J. Trappe 5903, 22 Aug. 1980 (OSC). *Lane Co.*, Willamette National Forest, McKenzie Pass, West Lava campground, J. Trappe 2190, 7 Aug. 1970 (ITCV, OSC) & Olallie trail, J. Trappe 1690, 8 Oct. 1968 (OSC). *Linn Co.*, Willamette National Forest, Crescent Mountain, J. Trappe 6859, 20 Aug. 1982 (OSC), Parish Lake Trail, A.B. Walters, J. Trappe 5978, 27 Sept. 1980 Wildcat Mountain Research Natural Area, Bunchgrass Mountain, J. Trappe 1706 & 1710, 9 Oct. 1968 (OSC). **Washington:** *Chelan Co.,* Okanogan National Forest, Rainy Pass, Lake Ann trail, K. Falter, J. Trappe 8958, 30 Aug. 1986 (OSC).

Discussion: *Gymnomyces abietis* varies strikingly with developmental stages and possibly with weather conditions at time of fruiting. Several of the collections examined contained many basidiomata at various stages of development. This is particularly useful for statismosporic taxa, from which no deposit of discharged, mature spores can be obtained. One sees young spores in young specimens, young and mature spores in specimens at intermediate stages of maturity, and fully mature spores in fully mature specimens. In *G. abietis* several taxa could be described on the basis of spore ornamentation if one had separate collections at different stages of maturity. Relatively young material would have spores with short, lightly and irregularly amyloid ornamentation with little or no amyloid deposits around the sterigmal appendage, few spores would be even partially reticulate. Well-matured specimens, on the other hand, would have taller, strongly and evenly amyloid ornamentation, heavy amyloid deposits around the sterigmal appendage, and most spores at least partially reticulate.

The frequent rupturing of the peridium and development of very large locules occurred in many but not all collections examined. These features may reflect weather favorable for rapid expansion of the basidiomata. The isolated inflated cells in the glebal trama appear to be constant although highly variable in number; clusters of extra large, thin-walled, inflated cells that appear to be sphaerocysts can be found at occasional junctures of tramal plates. Inflation of the subhymenial cells seems to progress as sporocarps mature and thus may not be obvious in relatively young specimens.

This species fits the description of *Martellia monticola* (Harkn.) Singer & Smith. Singer & Smith (1960) list Smith #60297 from Idaho as the only material they examined. On this basis we originally regarded *Gymnomyces abietis* to be *M. monticola* rather than a new species. Examination of Harkness #13 from BPI, the holotype of *Octaviania (Martellia) monticola,* however, revealed it to differ from Smith #60297. Harkness (1899) describes *O. monticola* as "buff ... gleba chestnut brown," whereas Singer & Smith (1960) describe Smith #60297 as "white ... pinkish-buff in age ...gleba ... 'pale pinkish buff ...'" Singer & Smith's Ridgeway colors equate to the ISCC-NBS (Kelly and Judd 1955) peridial and glebal colors we recorded for *G. abietis.* Moreover, the holotype of *O. monticola* has ellipsoid spores 9-14 x 8-11 µm with an ornamentation of unconnected, amyloid rods 0.5 µm tall, with a subhymenium of isodiametric cells 12 µm in diam, as opposed to the same structures of *G. abietis* as given above. Clearly, Smith #60297 is not *O. monticola* but represents the same undescribed taxon we have found in Oregon.

In the concept of Singer and Smith (1960), sphaerocysts in the tramal plates differentiate the genus *Gymnomyces* from *Martellia,* but distinguishing true sphaerocysts from individual inflated cells can be difficult. Many intermediates occur between these two genera, suggesting that their separation on that basis may be artificial. Lebel's (1998) studies of the type species for each genus and of many Australasian collections has led her to the same conclusion. Our data indicate that this species should be placed in *Gymnomyces.*

Gymnomyces abietis differs from *Martellia alba* (Harkness) Singer & Smith in lacking cystidia and gelatinized peridial hyphae. In addition, the spore ornamentation of *G. abietis* is strongly and evenly amyloid, with rods often joined to form short, thick lines. The spore ornamentation of *M. alba,* in contrast, is erratically amyloid (amyloid deposits mostly at tips of the rods), and the rods are occasionally connected by low, inamyloid lines. Moreover, the spores of *G. abietis* are globose to broadly ellipsoid and nearly all 8-10 µm long, whereas those of *M. alba* are all globose and nearly all 10-15 µm long.

Gymnomyces nondistincta Trappe & Castellano, sp. nov. (Fig. 8)

Basidioma 4 x5 cm, *characteribus nondistinctis, subglobosa, basi indentata. Peridium cremium, laeve. Gleba pallide testacea loculis rotundis* 0.2-0.5 *mm in diam. Sporae globosae,* 7-9 (-11) *µm in diam sine ornamentato, paries amyloideus; ornamentum virgae et spinae amyloideae* (0.5-) 1-1.5 (-2) x 0.5-1 *µm, saepe in lineis brevibus junctae, in locis papina sporarum granulis amyloideis, minutis. Holotypus* Trappe 649.

Basidioma 4 x 5 cm, subglobose, the base indented. **Peridium** cream color, slowly turning pale red-brown where handled, smooth. **Gleba** pale brown-yellow, with rounded locules 0.2-0.5 mm in diam lined by pale yellow spore deposits; columella lacking. **Odor** of wine. **Taste** not recorded.

Peridium 100-150 µm thick. **Epicutis** 25-50 µm thick, of appressed, thin-walled hyphae 2-4 µm in diam, the cell contents yellow-brown. **Subcutis** 75-125 µm thick, of interwoven, hyaline, thin-walled hyphae 2-4 µm in diam. **Trama** of subparallel-interwoven, hyaline, thin-walled hyphae 2-5 µm in diam. **Subhymenium** of interwoven, hyaline, thin-walled hyphae 2-5 µm in diam, with occasional cells inflated to 7-12 µm. **Basidia** clavate, 15-30 x 10-15 µm, with 1-4 sterigmata ±6 x 1 µm. **Cystidia** absent. **Clamp connections** absent.

Spores globose, 7-9 (-11) µm in diam, hyaline to pale yellow in KOH, in Melzer's reagent with gray walls ornamented with strongly amyloid rods and spines (0.5-) 1-1.5 (-2) x 0.5-1 µm, these often merged in 2's or 3's to form short lines, in places the spore surface with minute amyloid granules; sterigmal appendage inconspicuous, ±1 x 0.5 µm.

Etymology: Latin *nondistincta* (not distinctive), in reference to the lack of distinctive features of this species.

Distribution, habitat and season: Known only from the south slope of Mount Hood, Oregon at ca. 1,800 m elevation; under *Abies amabilis* and *Tsuga mertensiana;* September.

Collection examined: HOLOTYPE - Oregon: *Clackamas Co.,* Mount Hood National Forest, Mount Hood, Phlox Point, J. Trappe 649, 16 Sept. 1965 (OSC).

Discussion: By the concepts of Singer & Smith (1960), *Gymnomyces* is separated from *Martellia* by the former having sphaerocysts in the glebal trama and the latter lacking them. Lebel's (1998) studies of these genera, as noted in the discussion of *G. abietis,* provide strong evidence for synonymy of *Martellia* with *Gymnomyces*. Accordingly, although this new species could be described as a *Martellia* by the concepts of Singer and Smith, the merging of the two genera requires use of the name with priority, *Gymnomyces*. The distinctive feature of this species is its lack of distinctive features. Of the *Gymnomyces* or *Martellia* spp. with small, globose spores (Singer & Smith 1960, Smith 1963), *M. subochracea* Smith and *M. fragrans* Smith both have a peridial epicutis of dermatocystidia, which *G. nondistincta* lacks. *Martellia foetens* Singer & Smith has a spore ornamentation and peridial epicutis similar to that of *G. nondistincta* but has cystidia and a subhymenium of enlarged, isodiametric cells, both lacking in *G. nondistincta.*

Hydnotrya inordinata Trappe & Castellano, sp. nov. (Figs. 9-11)

Ptychothecia hypogaea, irregularia, convoluta, inplicata, 8-30 *mm in diam, maturitate e fusco castanea, plus minusve laevia. Gleba complexa, canalibus et loculis* 0.5-3 *mm latis et hymeniis tectis. Peridium* 120-180 *um crassum. Excipulum ectale* 40-75 *µm crassum, cellulis globosis vel ellipsoideis, radiatum serialibus. Excipulum entale* 40-120 *µm crassum, hyphis intertextis, cellis inflatis. Asci cylindrici, hyalini, fragile,* ±300 x 25-33 *µm. Paraphyses* 4-6 *µm in diam, septatae, hyalinae, apicibus clavatis et usque ad* 5-8 (-10) *µm inflatis, ascos per* 70-100 *µm excidentes. Sporae uniseriatae, globosoe vel ellipsoideae, maturitate ochraceae,* 20-30 x 20-28 *µm sine ornamentato; ornamentatum inordinatum, spinis aggregatis, flexuosis, diminutis, plerumque in muco inclusis. Holotypus* Trappe 792.

Ascomata hypogeous, irregular, convoluted and infolded ptychothecia with one or a few openings from the interior, 8-30 mm in diam, gray-pink and pubescent in youth, becoming dark red-brown and ± smooth but with soil and organic matter adhering to the surface at maturity. **Gleba** complex, of infolded tramal plates forming canals and chambers 0.5-3 mm broad, trama concolorous with the ascoma surface or paler, the canals and locules lined with hymenia pink-white in youth, becoming dark red-brown as spores mature, the tips of the paraphyses exceeding the asci and white to pale red-brown, in deteriorating specimens sometimes pale yellow. **Odor** and **taste** not distinctive.

Peridium 120-180 µm thick. **Ectal excipulum** 40-75 µm thick, of hyaline to yellow, globose to ellipsoid cells and obtuse to clavate, emergent hyphal tips 10-38 µm in diam, the walls 0.5-2.5 µm thick, the cells generally aligned in radiate rows. **Ental excipulum** 40-120 µm thick, of hyaline to yellow, interwoven, mostly thin-walled hyphae 5-12 µm in diam at the septa, the cells mostly inflated to 8-30 µm; as ascomata mature, scattered cells and lengths of aseptate hyphae filling with brown, amorphous pigment. **Gleba** with a medullary excipulum (trama) up to 1 mm thick, of tightly interwoven, hyaline, mostly thin-walled hyphae 4-8 (-10) µm in diam at septa, occasional cells inflated to 5-15 (-30) µm. **Subhymenium** similar to medullary excipulum except cells generally not inflated. **Asci** (6-) 8 spores per ascus, cylindric, mostly born in a hymenium but many also embedded in the subhymenium, hyaline, straight to sinuous, fragile and mostly breaking under pressure in microscope mounts, ±300 x 25-33 µm with a long-tapered base, the apex rounded, the lateral walls ± 1 µm thick, the walls immediately below the apex thickened up to 3 µm, the apex itself thin-walled and neither pored nor operculate, pale yellow in Melzer's reagent. **Paraphyses** crowded, 4-6 µm in diam, septate, hyaline, thin-walled, the cells below the tips not or only slightly inflated, the tips clavate and inflated to 5-8 (-10) µm, exceeding the asci by 70-100 µm and completely enclosing them.

Spores uniseriate, globose to ellipsoid, subhyaline in youth and brown-yellow at maturity, 20-30 x 20-28 µm in water excluding ornamentation, 2-5 µm larger in KOH mounts; ornamentation of crowded, flexuous, tapered spines 2-3 (-4) x 0.2-1 µm, these sometimes erect and free but more often disorderly and mucilage embedded, aggregated into clusters or collapsed into indistinct mats, young spores often with surface deposits of brown, amorphous material; spore walls ± 1 µm thick; spore contents at maturity a single, large guttule; in Melzer's reagent young spores subhyaline, mature spores brown-yellow; young spores cyanophilic, older spores cyanophilic or not.

Etymology: Latin, *inordinata* ("disorderly"), in reference to the spore ornamentation.

Distribution, habitat and season: Known only from Mount Jefferson Wilderness Area, Willamette National Forest, Oregon, at elevations of ca 1,800 m elevation; hypogeous under mature *Abies amabilis* and *Tsuga mertensiana*; July.

Collections examined: HOLOTYPE - Oregon, *Marion Co.,* Willamette National Forest, Mount Jefferson Wilderness Area, Jefferson Park, J. Trappe 792, 30 July 1966 (OSC); **PARATYPES - Oregon,** *Marion Co.,* Willamette National Forest, Mount Jefferson Wilderness Area, Jefferson Park, J.M. Trappe 771, 29 July 1966 (OSC); same locality J.M. Trappe 787, 30 July 1966 (OSC).

Discussion: The type locality of *Hydnotrya inordinata* is within the range of *H. cerebriformis* Harkness but seemingly a rather more mesic habitat than is usual for the latter. *Hydnotrya inordinata* has smaller ascomata and larger spores than *H.*

cerebriformis, and its disorderly spore ornamentation contrasts with the relatively orderly spinose ornamentation of *H. cerebriformis* spores (Gilkey 1939). The genus *Hydnotrya* has undergone various revisions published in scattered journals. These need to be consolidated in a modern treatment of the genus. Molecular data indicate that the genus *Hydnotrya* belongs in the Discinaceae (O'Donnell et al 1997).

Hydnotrya subnix Trappe & Castellano, sp. nov. (Figs. 12-14)

Ptychothecia irregularia, convoluta, inplicata, 50-65 *mm in diam, e fusco castanea, glabra vel asperula. Gleba complexa, canalibus et loculis* 1-10 *mm latis. Odor valde Allii ampeloprasi pungentis. Peridium* 130-300 *µm crassum. Excipulum ectale valle apicibus hyphalibus, obtusis vel clavatis, irregularibus, emergentibus. Excipulum entale* 90-250 *µm crassum, hyphis intertextis vel radiatis, cellulis plerumque inflatis. Asci cylindrici, hyalini,* 300-340 x 25-40 *µm. Paraphyses* 4-6 *µm in diam, septatae, hyalinae, apicibus clavatis et usque ad* 5-8 (-10) *µm inflatis, ascos per* 80-130 *µm excedentes. Sporae uniseriatae, globosoe vel raro ellipsoideae, maturitate brunneae,* 23-30 *µm in diam sine ornamentato, spinis aggregatis,* ±1 *µm elatis, reticulo partiali amorpho,irregulari, verruco textis. Holotypus* Trappe 1861.

Ascoma an irregular, deeply convoluted and infolded ptychothecium lacking openings from the interior, 50 x 65 mm in diam, dark red-brown, glabrous to minutely roughened. **Gleba** complex, of infolded tramal plates forming canals and locules 1-10 mm broad, trama concolorous with the ascoma surface, the canals and locules lined with concolorous hymenia, the tips of the paraphyses exceeding the asci and white to pale red-brown. **Odor** and **taste** strongly of spicy garlic.

Peridium 130-300 µm thick. **Ectal excipulum** 40-60 µm thick, a palisade of hyaline, obtuse to clavate, tapered, and irregular emergent hyphal tips 5-15 (-25) µm in diam, the walls thin to 1 µm thick, occasional cells with brown contents. **Ental excipulum** 90-250 µm thick, of hyaline to brown, interwoven to radiate, mostly thin- walled hyphae 5-12 µm in diam at the septa, the cells mostly inflated to 8-30 (-40) µm, scattered cells and lengths of sparingly septate hyphae with brown contents. **Gleba** with a medullary excipulum (trama) 300-500 µm thick, of tightly interwoven, hyaline, mostly thin-walled hyphae 4-8 (-10) µm in diam at septa, occasional cells inflated to 5-15 (-30) µm, scattered cells and lengths of hyphae with brown contents. **Subhymenium** similar to medullary excipulum except cells generally not inflated. **Asci** cylindric, mostly born in a hymenium but some also embedded in the subhymenium, hyaline, straight to sinuous, 300-340 x 25-40 µm with a long-tapered base, the apex rounded, the lateral walls ± 0.5-1 µm thick, the walls immediately below the apex thickened up to 2 µm, the apex itself thin-walled and neither pored nor operculate, pale yellow in Melzer's reagent, mostly 8 spores per ascus. **Paraphyses** crowded, 4-6 µm in diam, septate, hyaline, thin-walled, the cells below the tips not or only slightly inflated, the tips clavate and inflated to 5-8 (-10) µm, exceeding the asci by 80-130 µm and completely enclosing them.

Spores uniseriate, globose to rarely ellipsoid, brown-yellow in youth and brown at maturity, 23-30 µm in diam in both water and KOH mounts excluding ornamentation; ornamentation in youth of minute, crowded, mucilage-embedded spines ±1 µm tall, the spines soon covered by an amorphous, brown, irregular, warty partial reticulum 3-5 µm tall, the ridges and warts 0.5-4 µm broad; spore walls ±1 µm thick; spore contents at maturity a single, large guttule; in Melzer's reagent young spores yellow, mature spores orange-brown; young spores cyanophilic, older spores cyanophilic or not.

Etymology: Latin, *subnix,* (under snow), in reference to the occurrence of the type collection under a melting snow bank in the spring.

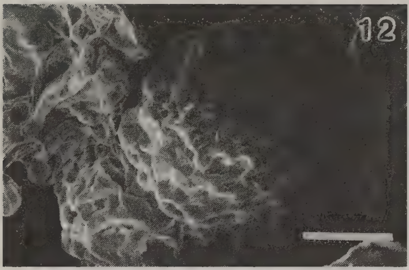
Distribution, habitat and season: Known only from the type locality in southwestern Washington at ca 950 m elevation; subhypogeous under a small, receding, icy snow bank ±10 cm thick, near *Abies amabilis*; June.

Collection examined: HOLOTYPE - Washington: *Skamania Co.,* east fork of Lewis River, on Gumboot Mountain Rd. by its junction with Canyon Rd., J.M. Trappe 1861, 5 June 1969 (OSC).

Discussion: Macroscopically *Hydnotrya subnix* resembles robust specimens of *H. cerebriformis.* Spores of the former are larger than those of the latter, however, and the spines become hidden under the mucilagenous reticulum of *H. subnix,* whereas those of *H. cerebriformis* remain prominent and visible through full maturity (Gilkey 1939).

The conspicuous ascoma of the type collection was essentially above the soil but under a small, icy snow bank, which was easily flipped over with a truffle fork. The metabolic heat of the ascoma had melted its image into the ice.

Figs. 12-19. Fig. 12. SEM of ascospores of ***H. subnix***, bar = 10 µm. Fig. 13. SEM of a single ascospore cut in half of ***H. subnix***, bar = 10 µm. Fig. 14. Sporocarp of ***Hydnotrya subnix***, bar = 20 mm. Fig. 15. Sporocarp of ***Tuber pacificum***, bar = 6 mm. Fig. 16. SEM of basidiospores of ***Rhizopogon ellipsosporus***, bar = 1 µm. Fig. 17. Sporocarps of ***Thaxterogaster pavelekii***, bar = 10 mm. Fig. 18. SEM of a single basidiospore of ***T. pavelekii***, bar = 4 µm. Fig. 19. SEM of ascospores of ***T. pacificum***, bar = 10 µm.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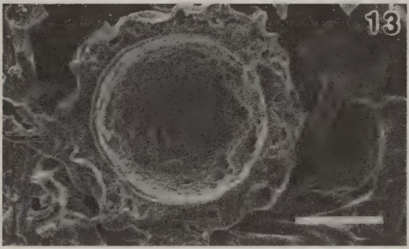
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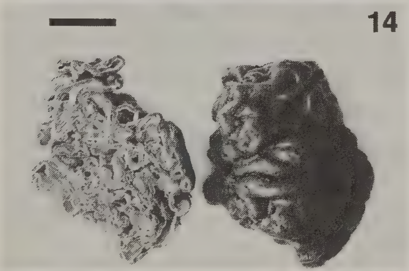
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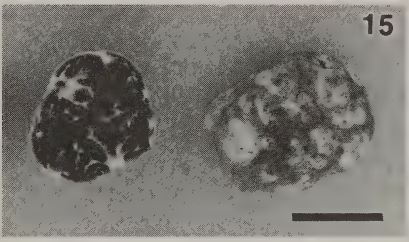
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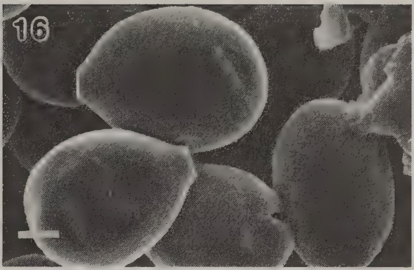
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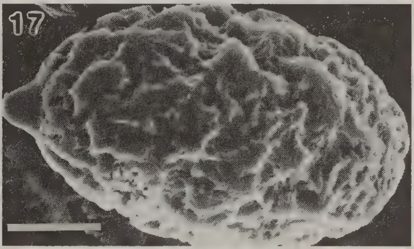
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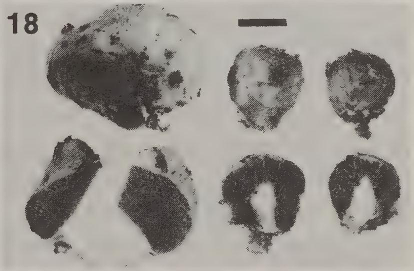
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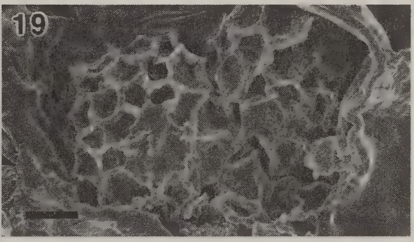
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Octavianina cyanescens Trappe & Castellano, sp. nov.

Basidiomata hypogaea, 12-25 *mm in diam, subglobosa vel plus minusve complanata coacta, eburnea vel luteola, areis febrarum umbrinarum, tarde cyanescentes ubi contusa. Gleba firma, humida, fuliginea vel picea, loculis rotundis, pro parte maxima sporis repletis. Sporae umbrinae, globosae vel interdum late ellipsoideae,* 13-18 (-20) *µm sine ornamento conorum subangularium* (3-) 4-5 (-7) x 1-6 *µm in* KOH 2-4 x 1-6 *µm in aqua spinis et conis parvulis aliquando interspersis, conae omnes spinae agglutinateae compositae. Holotypus* Trappe 7502.

Basidiomata hypogeous, 12-25 mm in diam, subglobose to ± flattened, felty, yellow-white to pale yellow, in places with a scant overlay of dark brown fibrils, overnight after collection developing dark blue stains where bruised. **Rhizomorphs** lacking. **Gleba** firm, moist, dark gray-brown to brown-black from the color of the massed spores, with gray tramal plates separating minute, rounded, mostly spore-filled locules. **Odor** not distinctive. **Taste** not recorded.

Peridium 150-300 µm thick. **Epicutis** a narrow layer of appressed, pale brown, thin-walled hyphae 2-7 µm in diam at the septa, occasional cells inflated to 5-10 µm. **Subcutis** with pale brown, thin-walled hyphae near the epicutis grading to hyaline near the gleba, 2-6 µm in diam at the septa but commonly inflated to 10-30 µm. **Trama** of hyaline, thin-walled hyphae 2-4 µm in diam at the septa, the cells often inflated to 4-8 µm. **Subhymenium** of hyaline, thin-walled, ± isodiametric cells 5-10 µm in diam. **Basidia** in a hymenium, clavate, hyaline, thin-walled, 30-35 x 11-14 µm, the sterigmata up to 5-7 x 1.5-2 (-3) µm. **Clamp connections** absent.

Spores dark brown, globose to occasionally broadly ellipsoid, 13-18 (-20) µm in diam excluding the ornamentation of subangular cones (3-) 4-5 (-7) x 1-6 µm in KOH, 2-4 x 1-6 µm in water, with occasional interspersed spines and smaller cones, all cones composed of agglutinated spines and forming 4-7 sided polygons at the base, sterigmata often remaining attached as an inconspicuous pedicel; in Melzer's reagent spore walls deep orange-red, ornamentation hyaline and only 2-4 µm tall, heated in cotton blue the spines forming the cones separating and becoming erect, 4-8 x 1.5-3 µm.

Etymology: Latin, *cyanescens* (becoming blue) in reference to the bluing reaction of the peridium after specimens are extracted from the soil.

Distribution, habitat and season: Known only from the type locality at 1,900 m elevation in the Cascade Range of Oregon; hypogeous under and probably ectomycorrhizal with mature *Tsuga mertensiana:* September.

Collection examined: HOLOTYPE - Oregon: *Lane Co.,* Willamette National Forest, English Mountain, above The Potholes, J.M. Trappe 7502, 20 September 1983 (OSC).

Discussion: The spore ornamentation of cones composed of agglutinated spines is characteristic of the genus *Octavianina sensu stricto. Octavianina cyanescens* differs from previously described species in the bluing reaction of the peridium and its relatively darkly pigmented and tall spore ornamentation. The only other species reported from western North America, *O. papyracea* Singer & Smith and *O. rogersii* Singer & Smith belong in other genera.

Rhizopogon ellipsosporus Trappe, Castellano & Amaranthus, sp. nov. (Fig. 16)

Basidioma hypogaeum, 15 x 24 *mm, subglobosum, brunneum, rhizomorphis dispersis, concoloribus, adpressis. Gleba avellanea, loculis rotundis, sporis repletis. Peridium* 120-160 *µm crassum, hyphis* 3-4 *µm in diam, cellulis multis, inflatis usque ad* 4-6 *µm, in KOH pigmento amorpho, avellaneo. Trama glebae hyphis* 2-*3 µm in diam. Subhymenium filamentosum. Basidia clavata* 12-24 x 4-10 *µm. Sporae* (4-) 4.5-6 x 3-4 *µm, ellipsoideae, obovoideae vel interdum irregulares, hyalinae. Holotypus* Trappe 9730.

Basidioma hypogeous, 15 x 24 mm, subglobose, moderate brown with scattered, appressed, concolorous rhizomorphs. **Gleba** solid, rubbery, pale yellow-brown, the color a combination of white to brown trama and pale brown-yellow spore masses filling the rounded locules 0.1-0.4 mm broad; columella lacking. **Odor** and **Taste** not recorded.

Peridium 120-160 µm thick, of appressed-interwoven, hyaline to pale yellow, thin-walled hyphae 3-4 µm in diam, many cells inflated to 4-6 µm, with abundant, extracellular deposits of amorphous yellow-brown pigment in KOH, in Melzer's reagent the pigment orange-brown. **Trama** with a central stratum of loosely interwoven, hyaline hyphae 2-3 µm in diam with gelatinous-thickened, glassy-appearing walls, the broad zones between the central strand and locule margins of similar but tightly interwoven hyphae that diverge to form a filamentous subhymenium. **Basidia** thin-walled, clavate, 12-24 x 4-10 µm, with interspersed brachybasidioles. **Brachybasidioles** ellipsoid, hyaline, 13-20 (-30) x 8-11 (-20) µm with walls gelatinous-thickened up to 5 µm. **Clamp connections** absent.

Spores (4-) 4.5-6 x 3-4 µm, ellipsoid to obovoid or occasionally irregular, smooth, thin-walled, the sterigmal attachment ± 1 µm broad, with a single, large guttule, in KOH hyaline singly, brown-yellow in mass, in Melzer's reagent pale yellow singly, brown-yellow in mass; cyanophilic.

Etymology: Latin, *ellipsosporus* (ellipsoid spored), in reference to the relatively broad spores compared to other *Rhizopogon* spp.

Distribution, habitat and season: Known only from the type locality at ca. 850 m elevation in the Siskiyou Mountains of southwestern Oregon; hypogeous in a mature stand of *Pseudotsuga menziesii, Pinus lambertiana* and *Arctostaphylos* spp.; October.

Collection examined: HOLOTYPE - Oregon: *Josephine Co.,* Siskiyou National Forest, end of Forest Service Rd. 2500518, M. Amaranthus, Trappe 9730, 22 Oct. 1986 (OSC).

Discussion: According to the concept of Smith and Zeller (1966), *Rhizopogon ellipsosporus* would be assigned to Section *Fulviglebae*. Molecular data indicate, however, that Sect. *Fulviglebae* is polyphyletic, and the spore truncation upon which it is based is not a useful subgeneric character (Grubisha, 1999). Instead, *R. ellipsosporus* is best assigned to Section *Rhizopogon.* The relatively short and broad spores of *R. ellipsosporus* distinguish it from other members of the section except *R. oregonensis* A.H. Smith, which differs in having peridial hyphae 4-10 (-15) µm in diameter and a subhymenium of isodiametric cells. It closely resembles *R. exiguus* Zeller in section *Fulviglebae*, but that species has more broadly truncate spores that range 7-8 x 5-5.5 µm in size.

Thaxterogaster pavelekii Trappe, Castellano & P. Rawlinson, sp. nov.(Figs. 17 & 18)

Basidiomata hypogaea, 7-40 x 12-35 *mm, convexa vel turbinata, ubi humida crassiviscida, ubi sicca nitida, pallide flavo-grisea vel pallide brunneo-grisea, interdum ad marginem pilei olivaceo-grisea vel brunneo-grisea, saepe radiatim virgata. Gleba loculis radiatim labyrinthiformibus, obscure cinnamomea vel umbrina, columella percurrenti et stipite subviscidi, saepe protruso. Peridium ixotrichodermium implexum. Sporae brunneae, ellipsoideae,* 14-18 (-21) x (8-) 9-10 (-11*) µm sine ornamentis; ornamentum linearum angustarum e verrucarum* 0.1-0.5 (-1) *µm altarum e latarum, interdum prope partim reticulatum. Holotypus* Trappe 7962.

Basidiomata hypogeous, 7-40 x 12-35 mm, convex to turbinate, the pileus margin appressed against protruding base or seceded up to a mm to expose underlying locules. **Peridium** thickly slimy-viscid when wet, shiny when dry, pale yellow-gray to pale brown-gray on the disc, towards the margin concolorous or grading to olive-gray or brown-gray, often radially streaked. **Gleba** with radiate-labyrinthiform locules, dark cinnamon to dark brown, with a percurrent stipe-columella that often protrudes beyond the glebal base; columella columnar and 1-2 mm broad or often greatly enlarged near the base, white to gray, in wet weather subviscid or with a viscid zone where the pileus margin is appressed, the context white throughout or in age becoming brown-yellow below. **Odor** faint or sometimes musty-raphanoid to sweet-medicinal. **Taste** not distinctive.

Peridium a tangled ixotrichodermium of thin-walled, hyaline hyphae 3-4 μm in diam, these becoming appressed to the surface on dried material. **Context** of loosely interwoven, thin-walled, hyaline hyphae 3-10 μm in diam at the septa, the cells mostly inflated to 5-20 (-30) μm, many isodiametric. **Trama** of subparallel, thin-walled, hyaline hyphae 3-6 μm in diam at the septa, some cells inflated up to 15 μm, infrequent golden brown laticiferous hyphae present. **Subhymenium** of ± isodiametric cells 5-15 (20) μm in diam. **Basidia** 30-40 x 9-11 μm, with 2-4 sterigmata ±5 x 1.5 μm, the hymenium hyaline but each basidium becoming golden brown as it begins to produce spores. **Clamp connections** absent.

Spores ellipsoid, 14-18 (-21) x (8-) 9-10 (-11) μm excluding the ornamentation of narrow lines and warts 0.1-0.5 (-1) μm tall and broad, sometimes nearly partially reticulate, the length:width ratio 1.5-2, bilaterally asymmetric with an offset sterigmal appendage ±1 x 1.5 μm, the spore wall ±1.5 μm thick; in KOH brown, in Melzer's reagent golden brown.

Etymology: In honor of our friend and colleague Henry Pavelek (deceased), collector of the type collection, enthusiastic collector of sequestrate fungi, and past president of the North American Truffling Society.

Distribution, habitat and season: Endemic to mature to old-growth coastal forests or forests with an old-growth legacy of coarse woody debris, usually in mossy places, from sea level to ±250 m elevation in Oregon and Washington; hypogeous under mature *Picea sitchensis* and *Pinus contorta,* occurring in pure stands of each or mixed stands of both; March, April, June, July, and November.

Collections examined: HOLOTYPE - Oregon: *Tillamook Co.,* near junction of Tierra del Mar, junction of Woods Rd. and Haystack Rock Rd., H. Pavelek, J. Trappe 7962, 10 June 1984 (OSC). **PARATYPES** - **Oregon:** *Lincoln Co.,* Agate Beach, P. Rawlinson, Trappe 13523, 14 April 1994; Cape Perpetua, P. Rawlinson, Trappe 6242, 24 March 1981 (OSC); Otter Rock, G. Coleman, Trappe 12420, 8 March 1992 (OSC); Yachats, J. Trappe 7427, 22 July 1983 (OSC). *Tillamook Co.:* Cape Lookout State Park, W. Fender, Trappe 4867, 21 Nov. 1976 (OSC); Three Capes Loop Highway 1.5 mi north of

Pacific City, W.C. Bushnell, Trappe 8520 (OSC); **Washington**, *Grays Harbor Co.*, Copalis, D. Stuntz 20388, 9 September 1978 (WTU).

Discussion: The only other *Thaxterogaster* sp. from coastal areas of the Pacific Northwest is *T. thiersii* Calhoun, which differs from *T. pavalekii* in having violaceous colors on the sporocarp and spores that are broader (to produce a smaller length:width ratio) and ornamented with coarse warts. Scanning electron microscope photos of *T. thiersii* show broad warts separated by narrow channels (Calhoun 1989); spores of *T. pavalekii*, in contrast, have narrow warts and ridges separated by broad areas of spore surface.

Tuber pacificum Trappe, Castellano & Bushnell, sp. nov. (Figs. 15 & 19)

Ascomata hypogaea, stereothecia hypogaea, subglobosa, convoluta, 6-9 x 4-9 *mm, alba areis, brunneolis, vade exarata. Gleba brunnea vel atrobrunnea, venis albis marniorata. Peridium* 250-400 *μm crassum. Excipulum ectale* 20-30 *μm crassum, hyphis adpressis vel implexis* 2-5 *μm in diam, cellulis multis, inflatis usque ad* 8-10 *μm. Excipulum entale hyphis* 1.5-3 *μm in diam, intertextis. Gleba hyphis, arcte intertextis,* 2-5 *μm in diam, cellulis interdum inflatis usque ad* 10 *μm. Asci ellipsoidei vel subglobosi,* 70-85 x 55-70 *μm, sporis* 1-4, *maturitate parietes usque ad* 2 *μm crassis, hyalinis. Sporae ellipsoideae, brunneae, in ascis unisporis* 39-45 x 29-35 *μm sine ornamentato, in ascis bisporis* 36-43 x 28-32 *μm, in ascis trisporis* 31-35 x 20-26 *μm, in ascis quadrisporis* 23-35 x 16-26 *μm; ornamentatum reticulatum alveolatum* (2-) 3 (-4) *μm elatum, alveolis* (4-) 6-10 *secus longitudem sporarum. Holotypus* Trappe 12493.

Ascomata hypogeous, subglobose, convoluted stereothecia, 6-9 x 4-9 mm, white with pale brown areas, shallowly furrowed, felty. **Gleba** solid, brown to blackish brown marbled with narrow, white veins. **Odor** and **taste** not recorded.

Peridium 250-400 μm thick. **Ectal excipulum** 20-30 μm thick, of appressed to tangled, hyaline to pale yellow hyphae 2-5 μm in diam at septa, the walls thin or up to 1 μm thick, many cells inflated to 8-10 μm in diam, in places abundant enough and with thickened walls to appear pseudoparenchymatous, other places with abundant, emergent, obtuse to tapered, bulbous, cystidioid or versiform hyphal tips. **Ental excipulum** of tightly interwoven, hyaline, thin-walled hyphae 1.5-3 μm in diam. **Glebal trama** with a medullary excipulum of tightly interwoven, hyaline hyphae 2-5 μm in diam at septa, occasional cells inflated up to 10 μm, the walls thin or occasionally up to 1.5 μm thick; internal veins similar but of less tightly interwoven tissue. **Asci** ellipsoid to subglobose, 70-85 x 55-70 μm, thin-walled in youth but at maturity the walls up to 2 µm thick, hyaline, stemless; inamyloid, 1-4 spores per ascus. **Paraphyses** absent.

Spores ellipsoid, brown, in 1-spored asci 39-45 x 29-35 µm excluding ornamentation, in 2-spored asci 36-43 x 28-32 µm, in 3-spored asci 31-35 x 20-26 µm, in 4-spored asci 23-35 x 16-26 µm; ornamentation an alveolate reticulum (2-) 3 (-4) µm tall, the alveolae with 5-6 sides and (4-) 6-10 along the spore length; spore walls 2-3 (-3.5) µm thick; lens effect in transmitted light lacking. Spores pale brown in Melzer's reagent, the ornamentation hyaline; cyanophilic.

Etymology: Referring to the Pacific Ocean, near which the known localities of this species occur.

Distribution, habitat and season: Coastal Oregon; hypogeous under and probably mycorrhizal with mature *Pseudotsuga menziesii* and *Tsuga heterophylla;* February, June and July.

Collections examined: **HOLOTYPE - Oregon**, *Lane Co.,* Siuslaw National Forest, Cumming's Creek trailhead, W. Bushnell, Trappe 12493, 24 June 1992 (OSC). **PARATYPES - Oregon:** *Lane Co.,* Siuslaw National Forest, Cummins Creek trailhead off Forest Service Rd. 1050, W. Bushnell, Trappe 11698, 8 Feb. 1991 (OSC); *Tillamook Co.,* Van Duzer Corridor, W. Bushnell, Trappe 9562, 22 July 1987 (OSC).

Discussion: *Tuber pacificum* differs from *T. rapaeodorum* Tul. & Tul. in lacking the erect, tapered, hyphal tips on the peridial surface and the pseudoparenchymatous ectal excipulum that characterise the latter. The peridium of *T. separans* Gilkey is minutely verrucose and regularly pseudoparenchymatous, in contrast to the smooth, largely prosenchymatous peridium of *T. pacificum.* The thick-walled asci of *T. pacificum* further distinguish if from the other two species.

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TWO NEW CORTICOLOUS SPECIES OF BUELLIA (PHYSCIACEAE) FROM THE IBERIAN PENINSULA

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ABSTRACT: Two corticolous species of *Buellia*, *B. iberica* and *B. mediterranea* are described as new to science from the Iberian Peninsula. Both taxa are widely distributed in the study area. *B. iberica* occurs mainly at high altitudes in the mountains and *B. mediterranea* at low altitudes in coastal localities. They are closely related and characterized by their ascospores, which are intermediate between the *Callispora*- and the *Buellia*-type. In the study area, the new species have been erroneously reported as *Buellia disciformis* (Fr.) Mudd, *B. erubescens* Arnold, *B. chloroleuca* Körb., *B. sanguinolenta* T. Schauer and *Rinodina ericina* (Nyl.) Giralt. The main distinguishing features between these taxa and the new species are briefly commented and a key is included. Habit photographs and illustrations of the ascospores of *B. iberica* and *B. mediterranea* are also provided

KEYWORDS: Lichens, taxonomy, *Buellia*, Physciaceae, flora of Iberian Peninsula.

INTRODUCTION

The genus *Buellia* s. lat. is a large cosmopolitan genus, represented by not less than about 400 taxa, according to HAWSWORTH *et. al.* (1995). Although the European saxicolous species (SCHEIDEGGER 1993), the tropical corticolous species (e.g. KALB & ELIX 1998, MARBACH 1999), as well as the American species (e.g. IMSHAUG 1951, 1955, NORDIN 1999) have been reasonably well documented, much less is known about the European corticolous species (e.g. SHEARD 1964, SCHAUER 1965, NORDIN 1996), specially from those growing in the mediterranean regions

This work continues and, to some extent, is derived from an article by GIRALT et al. (in press), treating some corticolous *Buellia* from the Iberian Peninsula. These former investigations have shown that the genus *Buellia* is much more diverse in the study area than previously suspected, and have resulted in several new combinations (GIRALT et al. op. cit., GIRALT submitted) and the discovery of new species. This paper describes two of the new species, both rather common in the Iberian Peninsula, particularly in Spain.

The delimitation of the genus *Buellia* is uncertain at the moment (MOBERG et al. 1999). After two groups were separated in the genera *Hafellia* (KALB 1986) and *Amandinea* (SCHEIDEGGER 1993), a more detailed fragmentation into 15 genera is proposed by MARBACH (1999). As a consequence the generic position of most species assigned to *Buellia* has to be revised, during which process the generic delimitations may have to be changed again. Before the new generic arrangement of *Buellia* s. lat. is accepted (or not) by the lichenological community, in particular by those working on Physciaceae, the new species are provisionally included in *Buellia* s. lat.

MATERIAL AND METHODS

The study is based on herbarium material mainly provinent from Spanish institutional and private herbaria (BCC, GZU, LEB, LISU, MAF, MUB, SALAF, SANT and VAB). Additional material from other European herbaria (e.g. BM, H, M, W), collected outside the Iberian Peninsula, has also been checked, but no specimen belonging to *Buellia iberica* or *B. mediterranea* was detected.

Observations and measurements of external features were made under a dissecting microscope. Light microscopy (LM) was carried out on squash preparations and sections cut by hand with a razor blade. They were usually mounted in water, when necessary followed by the addition of different stains and chemical reagents, as Lugol, potassium hydroxide (K) or hypochlorite solution (C), depending on the character investigated. Ascospore measurements were made in water at 1000x magnification and only well-developed spores lying outside the asci were measured. For each taxon at least 110 spores were measured. Mean value (M) and standard deviation (SD) were calculated. In the text, the results are given as (minimum value observed) M ± SD (maximum value observed). M, SD and n (the total number of spore measured) are given within parentheses.

Current mycological terminology has been employed and generally follows that of HAWKSWORTH et al. (1995). The terminology used for the asci follows that of RAMBOLD et al. (1994), for the excipulum- and ascospore ornamentation-types that of NORDIN (1996), while for the ascospore-types and ascospore-ontogenies the terminology of KALB (1986), MAYRHOFER (1982), SCHEIDEGGER (1993), GIRALT (1994) and GIRALT & MAYRHOFER (1995), is followed. The standardized methods of thin layer chromatography (TLC) (e.g. CULBERSON & AMMANN 1979; CULBERSON ET AL. 1981; CULBERSON & JOHNSON 1982) for the identification of lichen substances were employed.

KEY TO THE SPECIES

1. Ascospore wall clearly thickened at apices and septum, of the *Dirinaria*-type. Ascospore ontogeny of type-B (i.e. having internal apical wall-thickenings before the septum is inserted). Thallus mostly containing diploicin.
Rinodina ericina

1.*Ascospore wall not thickened (*Buellia*-type), thickened only at septum (*Physconia*-type) or subapically thickened (*Callispora*-type). Ascospore ontogeny of type-A (i.e. the septum is inserted before internal apical wall-thickenings become distinct). Thallus never containing diploicin.
2

2. Hymenium with numerous oil droplets.
3

2*. Hymenium without numerous oil droplets.
4

3. Thallus K+ yellowish-orange then red, mostly containing norstictic acid. Ascospores (21-)26-32(-35) x (11-)12-13(-16) µm.
Buellia sanguinolenta

3. Thallus K+ yellow (norstictic acid absent), mostly containing atranorin, fulgidin and fulgoicin. Ascospores (16-)19-25(-28) x 7.5-9(-11) µm.
Buellia disciformis

4. Thallus K+ yellowish-orange then red, norstictic acid present.
5

4*. Thallus never K+ yellowish-orange then red, norstictic acid absent.
6

5. Ascospores of the *Physconia*-type when young, then *Buellia*-type when mature, of (11-)13-16(-18) x (6-)7-8.5(-9.5) µm.

Buellia erubescens
(Chemotype I)

5* Ascospores of the *Callispora*-type when young, then *Buellia*-type when mature but always conserving tendencies of the *Callispora*-type, of (15.5-)17.5-21(-23) x (7-)7.5-9(-10) µm.

Buellia iberica
(Chemotype I)

6. Thallus KC+ and UV+ orange, section C+ orange (microscope slide!), containing 6-O-methylarthothelin.

Buellia chloroleuca

6*. Thallus KC- and UV-, section C-, 6-*O*-methylarthothelin absent. Thallus K+ yellow, containing only atranorin.

7

7. Excipulum K+ strong yellow, very well developed, 80-125 µm wide. Ascospores of the *Physconia*-type when young, then *Buellia*-type when mature.

Buellia erubescens
(Chemotype II)

7*. Excipulum K-, poorly developed, up to 60 µm wide. Ascospores of the *Callispora*-type when young, then *Buellia*-type when mature but always conserving tendencies of the *Callispora*-type.

8

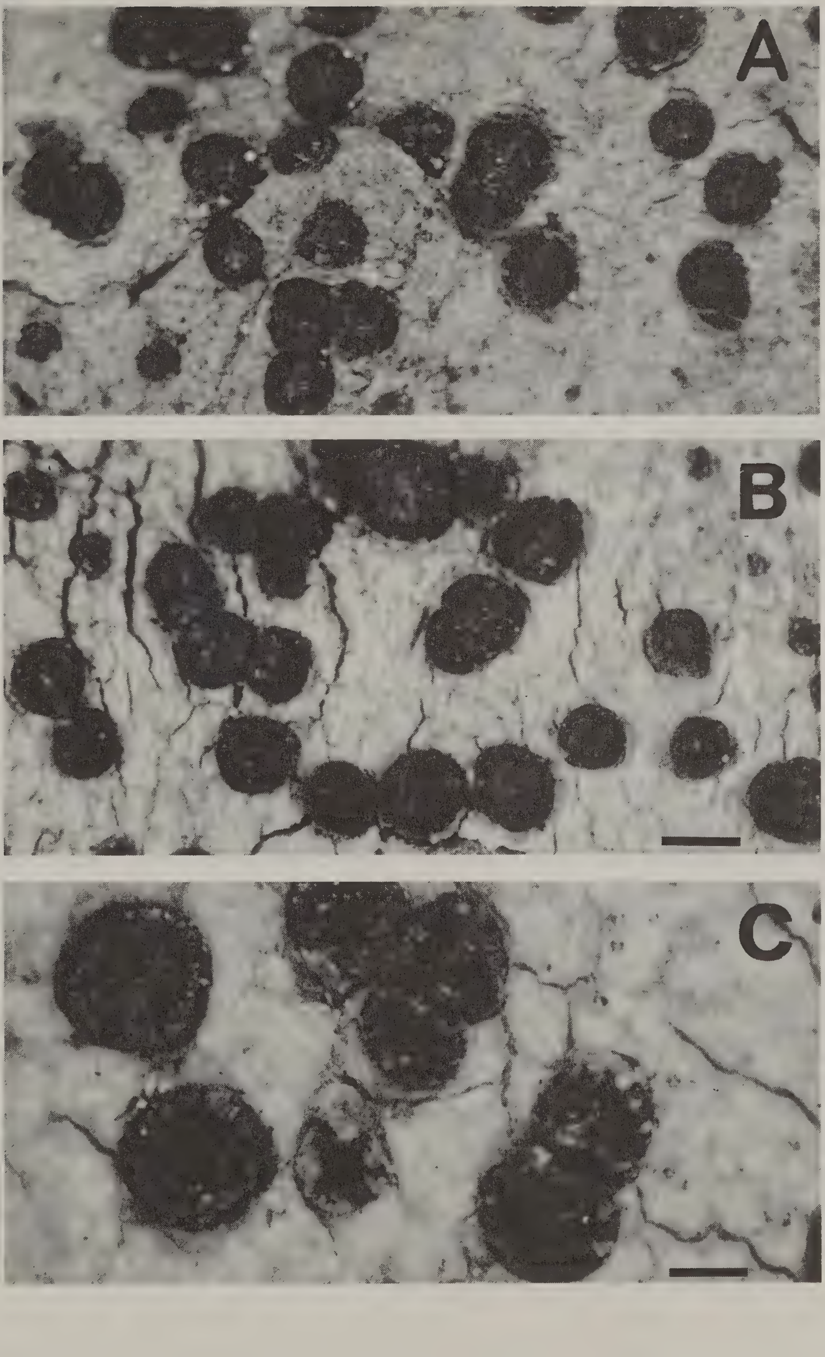
8. Ascospores (15.5-)17.5-21(-23) x (7-)7.5-9(-10) µm.

Buellia iberica
(Chemotype II)

8*. Ascospores (12-)14-17(-19) x (5-)5.5-7(-8.5) µm.

Buellia mediterranea

FIG. 1. Habit photographs of: A, *Buellia iberica* (BCC-3579); B, *Buellia mediterranea* (BCC-3434-holotype).Scale= 0.4 mm; C, Young apothecia of *B. mediterranea* in different stages of development. Scale: 0.2 mm.


A
B
C

THE SPECIES

Buellia iberica Giralt sp. nov.

Thallus crustaceus, continuus, tenuis, glaber vel rimosus, albus vel albogriseus, hypothallo saepe distincto. Apothecia numerosa, adnata vel sessilia, lecideina, ca. (0.2-)0.3-0.4(-0.6) mm *in diametro, disco plano vel subconvexo margine concolore circumdato. Excipulum vix evolutum, latere* 30-40(-50) *µm crassum, fusco-nigrum, K+ erubescens (cristallis acicularibus formans) vel K-. Hymenium* 60-80(-100) µm *altum, hyalinum purum. Hypothecium fusco-nigrum, abundanter guttulas olei inspersum. Paraphyses fere 2 µm crassae, capitulis* 3-4(-4.5) µm *crassis. Asci typo Bacidia. Ascosporae inter typum Callispora et Buellia conformatae,* (15.5-)17.5-21(-23) x (7-)7.5-9(-10) µm. *Spermatia non visa. Thallus acidum norsticticum, connorsticticum et atranorinum continens (Chymiotypus I) vel solum atranorinum continens (Chymiotypus II).*

Typus: Spain: Rioja: Sierra Cebollera, Viuvesa, 1700 m, on *Pinus*, 27 August 1993, J. Etayo (hb. Etayo-holotype).

(Fig. 1A, 2A, 3)

Thallus crustose, whitish to whitish grey, thin, smooth to rimose, sometimes delimited by a blackish prothallus. Apothecia (0.2-)0.3-0.4(-0.6) mm diam., abundant, adnate to sessile. Disc plane to subconvex, rarely convex. Proper margin initially rather thick and prominent, becoming thinner, rarely totally excluded. Excipulum poorly developed, 30-40(-50) µm wide, K+ yellow then forming red crystals or K- (microscope slide). Excipular hyphae of type 1 (i.e. they are rounded to elongate, rather thin-walled and more coloured in the outermost part, where the cells have 'apical caps' like the paraphyses (cf. Nordin 1996: 331; Fig. 1B)). Hymenium without oil droplets, 60-80(-100) µm high. Hypothecium with oil droplets. Paraphyses c. 2 µm wide; apical cells 3-4(-4.5) µm in diam., brown pigmented. Asci of the *Bacidia*-type. Ascospores (15.5-)17.5-21(-23) x (7-)7.5-9(-10) µm (M= 19.2;8.5 µm; SD=1.7; 0.7 µm; n= 110), of the *Callispora*-type when young, *Buellia*-type when mature but always conserving tendencies of the *Callispora*-type, sometimes triseptate; apices pointed, mostly curved. Perispore weakly ornamented. Ascospore ontogeny of type-A. Spermatia not seen.

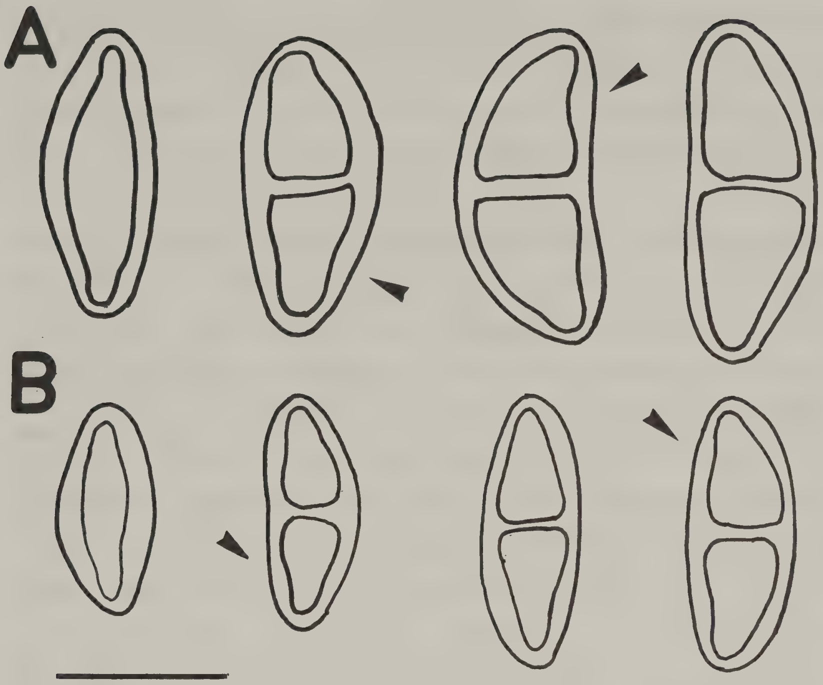


FIG. 2. Ascospore ontogeny of: A, *Buellia iberica* (BCC-holotype); B, *Buellia mediterranea* (BCC-holotype). *Buellia*-type ascospores showing tendencies to the *Callispora*-type (arrows). Scale = 10 µm.

Chemistry: Chemotype I: Thallus K+ yellow-orange to finally red, PD± yellow-orange; thallus section and excipulum K+ deep yellow, followed by the formation of red crystals (microscope slide!). Atranorin, norstictic and connortistic acids by TLC. Chemotype II: Thallus K+ yellow. Only atranorin by TLC.

Ecology and distribution: *Buellia iberica* is mainly a montane and supramediterranean species but it may also occur in humid localities at lower altitudes. It mainly grows on dry twigs of coniferous and evergreen shrubs and trees, and on lignum, where it usually forms small thalli among typical species present on conifers, such as *Pseudevernia furfuracea* (L.) Zopf, *Parmelia exasperatula* Nyl., *Lecanora* gr. *expallens* and *Caloplaca hungarica* H. Magn.. In the study area it is scattered but widely distributed from the Medioeuropean to the Mediterranean regions (suprameditteranean stages), being especially abundant at rather high altitudes in the Mediterranean mountains. Records of *B. disciformis* (MARCOS 1985, BOQUERAS et al. 1989), *B. erubescens* (GÓMEZ-BOLEA 1985, MARCOS op.cit.), and *Rinodina ericina* (BOQUERAS et al. op. cit.), from the study area refer to this species.

Discussion: *Buellia iberica* is characterized by the thalline chemistry, the small apothecia, the absence of hymenial oil droplets and the *Buellia*-type ascospores which clearly grade into the *Callispora*-type.

Among the corticolous *Buellia* species present in the study area, *B. iberica* can only be mistaken for *B. erubescens* as this species also contains norstictic acid. However, *B. erubescens* is clearly distinguished by its larger apothecia with a better developed excipulum which always gives a K+ strong yellow reaction and by its significantly smaller ascospores which, furthermore, are straight, have rounded apices and do not show tendencies to the *Callispora*-type. The different ecology also separates both taxa, since *B. erubescens* is specially common in the atlantic regions of the Iberian Peninsula, and grows from low to middle altitudes, usually on smooth bark of deciduous trees.

The oceanic *B. sanguinolenta,* at present not found in the study area, contains the same chemical substance, but is readily separated by having oil droplets in the hymenium and much larger ascospores (cf. GIRALT et al. in press).

Like *B. erubescens, B. iberica* has two chemotypes, one characterized by the presence of atranorin, norstictic and connorstictic acids and a second (rare) containing only atranorin. Specimens belonging to the chemotype II of *B. iberica* could be mistaken for *B. mediterranea*. In these cases, the size of the ascospores easily separates the taxa (see FIGS. 2-3). Additional features of *B. iberica* which may help to separate it from *B. mediterranea* are found in the degree of development of the excipulum, the size of the apical cells of the paraphyses and in the ascospore ornamentation, as well as in the different ecology (compare descriptions and ecology and distribution of both taxa). Furthermore the ascospores of *B. mediterranea* never become triseptate.

In the study area, *B. iberica* has often been mistaken, not only for *B. erubescens*, but also for *B. disciformis* and *Rinodina ericina.* Both taxa are clearly separated from *B. iberica* by containing different secondary lichen compounds, namely fulgidin and fulgoicin in the former, and diploicin in the latter. Furthermore, *B. disciformis* has oil droplets in the hymenium and larger ascospores with more pronounced and constant subapical wall thickenings (cf. GIRALT et al. in press) and *Rinodina ericina* has smaller ascospores of the *Dirinaria*-type (cf. GIRALT submitted).

Selected specimens examined: Andorra. Vall d'Incles, 1800 m, on *Abies alba*, 29.8.1981, A. Gómez-Bolea (BCC-3302). **Portugal.** Algarve: Serra de Monchique, road Casais to Marmelete near Rua Nova, 400 m, on *Quercus suber,* 23.7.1993, P.v.d. Boom, (hb. Boom-14621).- Tras os Montes: Parque Natural de Montesinho, 10 km W of Bragança, near Gondesende, 900 m, on wood *Castanea sativa,* 3.7.1995, P.v.d. Boom (hb. Boom-16900). **Spain.** Aragón: Zaragoza, Moncayo, 2300 m, on *Pinus sylvestris,* 6.9.1984, A. Gómez-Bolea (BCC-3761).- Castilla-La Mancha: Ciudad Real, Solana del Pino, umbría Valle de Alcudia, 900 m, on *Q. ilex*, 4.2.1997, F.J. Sarrión et al. (hb. Sarrión-1113*)*.- Castilla-León: Salamanca, El Maillo, on *P. pinaster, Q. pyrenaica, Erica australis* and *Chamaespartium tridentatum,* 8.3.1981, B. Marcos (SALAF-1678, 278, 1363, 1362). La Vallejera, on *P. pinaster,* 7.6.1982, B. Marcos (SALAF-1364). Candelario, 1300 m, on *E. arborea,* 3.7.1984, B. Marcos & F. Navarro (SALAF-1365). Monsagro-Peña de Francia, on *Taxus baccata,* 12.6.1984, B. Marcos & F. Navarro (SALAF-1383, 1384, 1526). La Alberca, El Portillón, 1220 m, on *E. umbellata,* 31.5.1987, B. Marcos (SALAF-2140). Navarredonda de la Rinconada, on *E. lusitanica,* 22.11.1981, B. Marcos (SALAF-1422). Soria, Moncayo, Monte de la Mata, 1340 m, on *P. sylvestris* and *Juniperus nana,* 4.9.1984, A. Gómez-Bolea (BCC-3579, 3580). Moncayo, Barranco de Castilla, 1230 m, on *E. arborea,* 4.9.1984, A. Gómez-Bolea (BCC-3716).- Catalunya: Cerdanya, La Molina, 1600-1900 m, on *Rhamnus alpina* and *Abies alba,* 22.11.1981, A. Gómez-Bolea (BCC-3303, 3304). Terra Alta, Arnes, Barranc del Grevolar, Serra dels Ports, 800-900 m, on *J. oxycedrus,* 20.10.1990, M. Boqueras et al. (BCC-5775). - Pais Valencià: Castelló, El Campello, Morella, 1000 m, on *P. nigra,* 7.5.1986, V. Atienza (GZU).

BUELLIA MEDITERRANEA GIRALT SP. NOV.

Buellia iberica similis, sed differt sporis minoribus, ca. 16 x 6.5 µm et thallo acidum norsticticum destitutum.

Typus: Spain: Catalunya: Baix Empordà, Begur, 260 m, on *Pinus,* 21 July 1984, A. Gómez-Bolea (BCC-3434-holotype)

(FIG. 1B-C, 2B, 3)

Thallus crustose, whitish to whitish grey, thin, smooth to rimose, often delimited by a blackish prothallus. Apothecia (0.2-)0.4-0.6 mm diam., adnate to sessile. Disc plane to subconvex, rarely convex, usually epruinose but sometimes covered by a fine, whitish pruina. Proper margin initially rather thick and prominent, becoming thinner, rarely totally excluded. Excipulum 40-60 µm wide, K- (microscope slide). Excipular hyphae of type 1. Hymenium without oil droplets, 70-90 µm high. Hypothecium with oil droplets. Paraphyses c. 2 µm wide; apical cells (3-)4-5.5 µm in diam., brown pigmented. Asci of the *Bacidia*-type. Ascospores (12-)14-17(-19) x (5-)5.5-7(-8.5) µm (M= 15.9;6.4 µm; SD=1.5;0.6 µm; n= 113), of the *Callispora*-type when young, *Buellia*-type when mature but always conserving tendencies of the *Callispora*-type; apices pointed, often slightly curved. Perispore roughly ornamented. Ascospore ontogeny of type-A. Spermatia not seen.

Chemistry: Thallus K+ yellow. Atranorin by TLC.

Ecology and distribution: *Buellia mediterranea* seems to be a maritime species, widely distributed in the Mediterranean regions (including southern Portugal) where it occurs from the coast to the hinterland and from low to middle altitudes. It mainly grows on twigs of evergreen shrubs and trees including conifers. It usually forms small thalli among other species, such as *Lecanora strobilina* (Spreng.) Kieff., *Lecidella elaeochroma* (Ach.) Haszl. and *Lecanora* gr. *subfusca*. The new species is rarely found with nitrophilous species, such as *Xanthoria parietina* (L.) Th. Fr. and *Physcia adscendens* (Fr.) H. Olivier. In the study area, it has previously been reported as other species, e.g. *B. disciformis* (ATIENZA 1990), *Rinodina ericina* (BOQUERAS & GÓMEZ-BOLEA 1986), *Amandinea punctata* (Hoffm.) Coppins & Scheid. (MARCOS 1985) and *B. erubescens* (FOS 1998).

Discussion: *Buellia mediterranea* is characterized by the small, thin thalli containing only atranorin, the absence of hymenial oil droplets, the small to medium-sized apothecia, the K- excipulum, the large apical cells of the paraphyses and the small *Buellia*-type ascospores which always show tendencies of the *Callispora*-type. Among the corticolous *Buellia* species present in the study area, *B. mediterranea* can be confused with *B. iberica* and with *Amandinea punctata* coll. Mainly the smaller ascospores and the alternative chemistry distinguish *B. mediterranea* from *B. iberica* (see FIGS. 2-3 and the discussion in *B. iberica*). The typical *Buellia*-type ascospores and the lack of chemical substances separate *Amandinea punctata* from *B. mediterranea*.

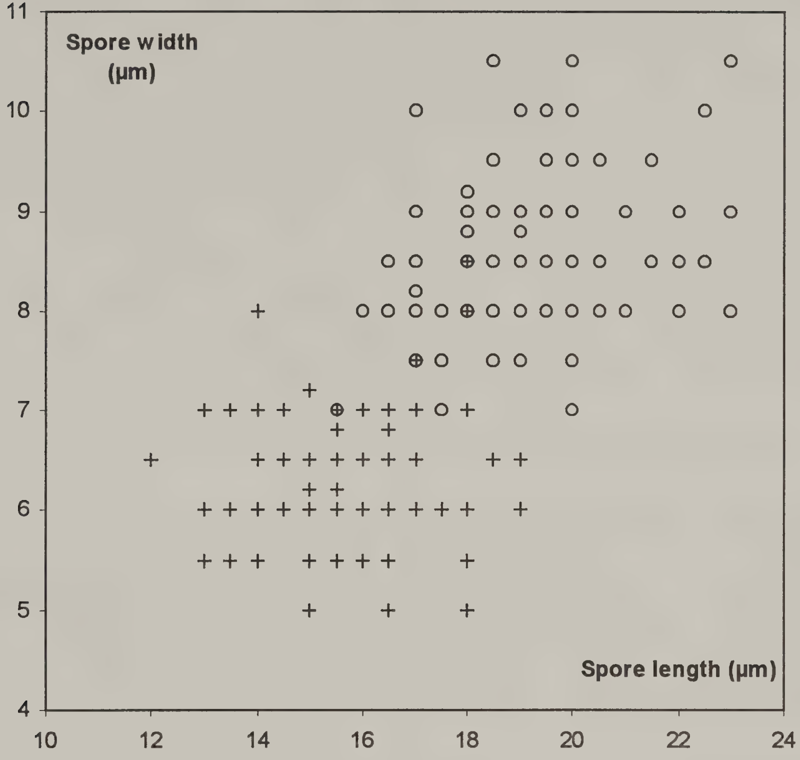


FIG. 3. Spore length and width in µm of *Buellia* iberica (o) and *Buellia mediterranea* (+).

Selected specimens examined: Portugal. Algarve: 14 km WSW of Lagos, along road to Salema, 50 m, on *Ficus carica,* 23.7.1993, P.v.d. Boom (hb. Boom-14682). N of Albufeira, 1 km N of Alte, near spring, 400 m, 30.7.1993, P.v.d. Boom (hb. Boom-14399).- Baixo Alentejo: Odemira, Serra do Cercal, Fonte Soude, 173 m, on *Quercus suber,* 20.5.1990, Barreno & Fos (VAB-9695). **Spain.** Andalucía: Cádiz, Tarifa, Sierra de Saladavieja, Cañada de la Jara, 140 m, on *Q. suber,* 18.10.1992, S. Fos (VAB-9669).- Catalunya: Baix Ebre, Roquetes, Barranc del Lloret, Serra dels Ports, 300-400 m, on *Nerium oleander,* 5.7.1987, M. Boqueras et al. (BCC). Benifallet, Ermita de San

Onofre, 550 m, on *Q. ilex,* 14.11.1987, M. Giralt et al. (hb. Giralt). Barranc de Planelles, 400 m, on *Pistacea lentiscus* and *Q. coccifera,* 5.11.1988, M. Giralt et al. (hb. Giralt). Baix Empordà, Begur, 260 m, on *Olea europaea,* 21.7.1984, A. Gómez-Bolea (BCC-3435). Sa Tuna, 260 m, on *Q. suber,* 18.10.1985 (BCC-3885). La Selva, camí de Lloret a Tossa, 150 m, on *Q. suber,* 20.3.1982, A. Gómez-Bolea (BCC-3716). Palafrugell, Cap Roig, 60 m, on *Q. suber,* 12.10.1991, S. Fos (VAB-3897). Tarragonès, Punta de la Mora, 20 m, on *Pinus halepensis*, 15.2.1987, M. Giralt (BCC-3995). Altafulla, Tamarit, on *P. halepensis,* 10 m, 1984, M. Giralt (hb. Giralt). Mas de'n Casido, 25-50 m, on *Q. coccifera* and *Q. ilex,* M. Giralt (hb. Giralt). - Pais Valencià: Castelló, Gorgo, on *Q. suber*, 4.2.1984, V. Atienza (VAB-441). Vallbona, Coto de Santo Domingo, 700 m, on *P. halepensis* and *Q. ilex,* 29.6.1987 and 28.8.1984, V. Atienza (VAB-943, 942). Morella, Masia Xivacolla, 940 m, on *Q. ilex,* 27.9.1984, V. Atienza (VAB-944). Los Roquedales, 725 m, on *Q. suber,* 28.9.1986, A. Muñoz (VAB-320).

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FIVE NEW SPECIES IN THE LICHEN FAMILY PARMELIACEAE (ASCOMYCOTINA) FROM GRANDE TERRE, NEW CALEDONIA

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ABSTRACT: The following new species are described: *Bulbothrix pinguiacida* Louwhoff & Elix, *Hypotrachyna montkoghisensis* Louwhoff & Elix, *Parmelina kanakia* Louwhoff & Elix, *Parmotrema pustulatum* Louwhoff & Elix and *P. sarrameanum* Louwhoff & Elix.

Introduction

As part of an extensive study of the taxonomy, phytochemistry and distribution of the lichen family Parmeliaceae in the Pacific islands, the following five species, from Grande Terre, New Caledonia, are described as new based upon their morphological and chemical characteristics. Chemical constituents were identified by thin layer chromatography (Culberson 1972; Culberson *et al.* 1981; Culberson & Johnson 1982; Elix & Ernst-Russell 1993), high performance liquid chromatography (Elix *et al.* 1997; Feige *et al.* 1993) and comparison with authentic samples.

Bulbothrix pinguiacida Louwhoff & Elix, sp. nov. Fig. 1

Thallus ut in *Bulbothrix lopezii* sed superfice superiore sorediata et ciliis parum tumidis differt.

Type: New Caledonia. Grande Terre: Ciu Cascades, near Canala, 21°37'S, 165°38'E, 400 m, on exposed rocks, *S. Louwhoff 754 & J-M. Porigneaux*, 29 June 1999; holo: PC; iso: CANB.

Thallus foliose, moderately adnate, membranaceous, 2-4 cm wide. *Lobes* imbricate, subirregular, rounded at apices, 1.5-3 mm wide; margins sinuous to crenate, densely ciliate; cilia enlarged at base but not conspicuously bulbate, ±ascending, simple or occasionally dichotomously branched, tapering towards apices, black, up to 1 mm long. *Upper surface* grey, becoming somewhat darker and ±pruinose at apices, emaculate, central lobes occasionally becoming lobulate-distorted and ±pustulate-sorediate; soredia granular, becoming corticate. Medulla white. *Lower surface* black, ±rugulose, with a shiny, brown, marginal zone; rhizines scattered, black, simple, often absent from marginal zone. *Apothecia* and *pycnidia* not seen.

Chemistry. Cortex K+ yellow; medulla K-, C-, KC-, P+ orange; containing atranorin (major), chloroatranorin (minor), fatty acids and ±trace of lecanoric acid (contaminant?).

Bulbothrix pinguiacida is characterized by the ascending or subascending cilia with an enlarged rather than distinctly bulbate base, the medullary fatty acids and the occasionally lobulate-distorted lobes which develop pustulate soralia where the granular soredia ultimately become corticate. *Bulbothrix lopezii* Hale is the only other *Bulbothrix* species which produces fatty acids, but it is readily distinguished by the dense, dichotomously branched, dorsiventral lobules, the consistent lack of soredia, the markedly inflated cilia and the corticolous substrate. This new species is only known from the type locality where it was collected from exposed rocks near waterfalls, at approximately 400 m altitude.

Additional Specimen Examined

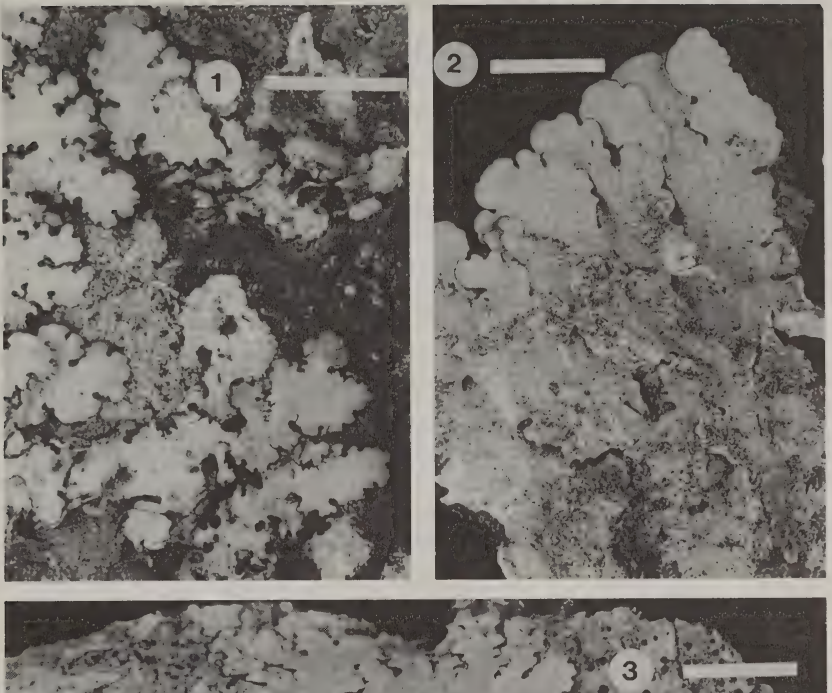
NEW CALEDONIA. Grande Terre: Ciu Cascades, near Canala, 21°37'S, 165°38'E, 400 m, on exposed rocks, *S. Louwhoff 740 & J-M. Porigneaux*, 4.vii.1999 (CANB).

Hypotrachyna montkoghisensis Louwhoff & Elix, sp. nov. Fig. 2

Thallus ut in *Hypotrachyna neodissecta* sed acidum salazinicum continente differt.

Type: New Caledonia. Grande Terre: Mt Koghis, Malaoui Peak walk, 22°13'S, 166°32'E, *ca.* 600 m, on tree trunk, *S. Louwhoff 1018 & J-M. Porigneaux*, 5 July 1999; holo: PC; iso: CANB.

Thallus foliose, moderately to tightly adnate, membranaceous, 2-6 cm wide. *Lobes* sublinear-elongate, contiguous to subimbricate, rounded at apices, (1-)2-4 mm wide; margins dark brown to black, entire or irregularly crenate to sinuous, particularly at apices. *Upper surface* grey-green, smooth or occasionally very finely faveolate, emaculate but ±irregularly cracked centrally, isidiate; isidia moderately dense, mostly occurring in laminal to submarginal clusters, cylindrical but frequently enlarged at the base (±flask-like), simple, up to 0.5 mm high and 0.15 mm wide, apices dark-tipped, syncorticate. Medulla white. *Lower surface* black, shiny, smooth to finely rugulose centrally, with a thin (up to 1 mm), pale brown to ±mottled marginal zone; rhizines moderately dense to dense, dichotomously branched, dark brown to black centrally, very pale brown along margins,



Figures 1-3. New species of Parmeliaceae: 1, *Bulbothrix pinguiacida* (isotype in CANB); 2, *Hypotrachyna montkoghisensis* (isotype in CANB); 3, *Parmelina kanakia* (isotype in CANB). Scale bar = 5 mm.

continuing up to approximately 1 mm from apices but occasionally extending right up to margin in lobe axils. *Apothecia* and *pycnidia* not seen.

Chemistry. Cortex K+ yellow; medulla K+ yellow turning deep red, C-, KC+ red, P+ orange; containing atranorin (minor), chloroatranorin (trace), salazinic acid (major), gyrophoric acid (minor), consalazinic acid (trace).

This species is characterized by the presence of salazinic and gyrophoric acids in the medulla, by the ±contiguous, rounded rather than sublinear, dichotomously branched, truncate lobes typical of *Hypotrachyna*, and by the flask-like, simple isidia. It is the only species of *Hypotrachyna* known to produce both salazinic and gyrophoric acid. This combination of secondary metabolites readily distinguishes *Hypotrachyna montkoghisensis* from the other isidiate, gyrophoric acid-producing species: *H. neodissecta* (Hale) Hale, *H. incognita* (Kurok.) Hale and *H. osorioi* (Hale) Hale, as well as from the isidiate, salazinic acid-producing species, *H. awasthii* Hale & Patwardhan, *H. ramkhamhaengiana* Elix & Pooprang and *H. quaesita* (Kurok.) DePriest & B. Hale. In addition, a number of morphological characteristics, such as the growth habit and the size of isidia and lobes, distinguishes this new species. At present, *Hypotrachyna montkoghisensis* is only known from the type locality, where it is corticolous, occurring in undisturbed *Melaleuca* forest with fern understorey, at approximately 600 m altitude.

Parmelina kanakia Louwhoff & Elix, sp. nov. Fig. 3

Thallus ut in *Parmelia pseudorelicina* sed superfice superiore isidiata et acidum salazinicum continente differt.

Type: New Caledonia. Grande Terre: Mt Mou, near sanitarium entrance, 22°05'S, 166°22'E, 500 m, corticolous in wet, disturbed forest, *S. Louwhoff 716 & J-M. Porigneaux*, 28 June 1999; holo: PC; iso: CANB.

Thallus foliose, adnate, 2-6(-10) cm wide. *Lobes* ±imbricate, subirregular to sublinear or rarely sublinear-elongate, (0.5-)1-3 mm wide; margins sinuous or becoming crenate, sparingly to moderately ciliate; cilia simple, black, 0.1-0.3 mm long. *Upper surface* pale grey to grey-green, flat, rarely faintly white-maculate, smooth to ±faveolate at first, becoming rugulose towards centre, ±pruinose towards apices, isidiate; isidia laminal, scattered or forming dense clusters, cylindrical but commonly somewhat inflated at apices, erect, rarely branched, up to 0.25 mm high, apices syncorticate. Medulla white. *Lower surface* black with a narrow (up to 1 mm), pale brown, erhizinate marginal zone; rhizines moderately dense to dense, black, simple, up to 0.1-0.2 mm long. *Apothecia* common, sessile, 1-2(-3) mm wide; disc initially concave, becoming flat or ±undulating, smooth; thalline exciple entire, isidiate. *Ascospores* subglobose, (6-)7.5-8.5(-9) x (5-)6-7.5 µm. *Pycnidia* laminal, immersed. *Conidia* bacilliform, 5-7.5 x 1 µm.

Chemistry. Cortex K+ yellow; medulla K+ yellow then red, C-, KC+ red, P+ orange; containing atranorin (minor), chloroatranorin (minor), salazinic acid (major), consalazinic acid (minor), hypoconstictic acid (minor), norstictic acid (trace), cryptoconstictic acid (trace).

This new species is characterized by the medullary chemistry, the sparse to moderately dense cilia and by the cylindrical isidia which are commonly somewhat inflated at the apices. Morphologically *P. kanakia* resembles *P. pseudorelicina* (Jatta) Kantvilas & Elix, but the latter is readily distinguished by the lack of isidia, the presence of lecanoric acid rather than salazinic acid, and by the weakly fusiform, somewhat longer (7-8 µm *cf.* 5-7.5 µm) conidia (Elix 1994a). This species is named in recognition of the Kanaky people, the Melanesian inhabitants of New Caledonia.

Paratype Specimens Examined

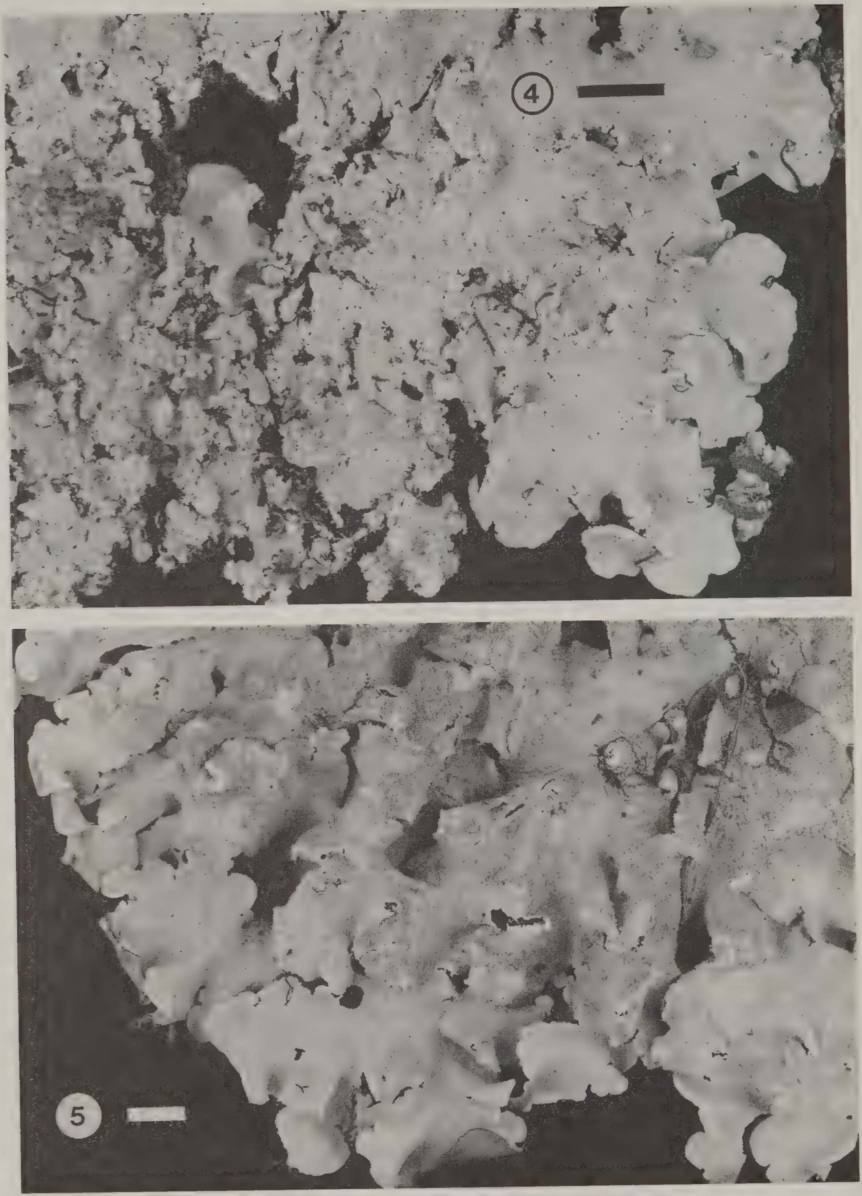
NEW CALEDONIA. Grande Terre: Near Parc Forestier Botanic Gardens, 22°16'S, 166°28'E, on bark of tree along roadside, *S. Louwhoff 669 & J-M. Porigneaux*, 27.vi.1999 (CANB); Mt Mou, near sanitarium entrance, 22°05'S, 166°22'E, 500 m, on smooth barked tree in disturbed wet forest, *S. Louwhoff 672, 707, 711 & J-M. Porigneaux*, 28.vi.1999 (CANB); Mt Mou, at beginning of walking track to summit, 22°05'S, 166°22'E, 500 m, on smooth barked tree in undisturbed wet forest, *S. Louwhoff 945, 968 & J-M. Porigneaux*, 4.vii.1999 (CANB); Touaoura, near Yaté, 22°14'S, 166°52'E, 1 m, on coastal tree, *S. Louwhoff 1077 & J-M. Porigneaux*, 6.vii.1999 (CANB); Mt Doré, E of Le Mont Doré township, 22°17'S, 166°43'E, 1 m, on tree in coastal flats, *S. Louwhoff 1081 & J-M. Porigneaux*, 7.vii.1999 (CANB).

Parmotrema pustulatum Louwhoff & Elix, sp. nov. Fig. 4

Thallus ut in *Parmotrema judithae* sed superfice superiore pustulata differt.

Type: New Caledonia. Grande Terre: Mt Mou, at beginning of walking track to summit, 22°05'S, 166°22'E, 500 m, corticolous in wet, undisturbed forest, *S. Louwhoff 961 & J-M. Porigneaux*, 4 July 1999; holo: PC; iso: CANB.

Thallus foliose, moderately adnate to adnate, membranaceous, occasionally becoming ±coriaceous, 4-8 cm wide. *Lobes* subirregular, 4-7 mm wide, often rounded towards apices; margins undulating, entire to crenate or weakly incised and ±sublaciniate, ascending near pustules, eciliate or rarely sparingly ciliate; cilia simple, black, up to 1 mm long. *Upper surface* dusty grey-green, dull, finely white-maculate, lacking isidia but with pustulate soredia; pustules mostly marginal, sometimes spreading submarginally, erupting to form granular soredia. Medulla white. *Lower surface* black, ±rugulose, shiny, with a broad, pale brown, erhizinate marginal zone; rhizines moderately dense to dense, simple, up to 0.5 mm long. *Apothecia* not seen. *Pycnidia* rare, conidia not seen.



Figures 4-5. New species of *Parmotrema*: 4, *Parmotrema pustulatum* (isotype in CANB); 2, *P. sarrameanum* (isotype in CANB). Scale bar = 5 mm.

Chemistry. Cortex K+ yellow; medulla K-, C-, KC+ pale yellow, P+ orange-red; containing atranorin (minor), chloroatranorin (minor), succinprotocetraric acid (major), fumarprotocetraric acid (minor), protocetraric acid (minor), ±virensic acid (trace), ±gyrophoric acid (trace).

This species is characterized by the conspicuous, sorediate pustules and the medullary chemistry. Morphologically and chemically it closely resembles *Parmotrema judithae* Elix & J.Johnst., a species reported from Queensland, Australia (Elix 1994b) and also collected in New Caledonia. *Parmotrema judithae* is readily distinguished from *P. pustulatum* by the lack of pustules and cilia, by the coriaceous rather than membranaceous thallus and by the rugose lower surface. *Parmotrema flaccidifolium* (Kurok.) Streimann, collected from Australia (Elix 1994b) and Papua New Guinea (Kurokawa 1979; Louwhoff & Elix 1999), is chemically similar to the above-mentioned species but has long, dense cilia, is ±sublaciniate and lacks pustules.

Paratype Specimens Examined

NEW CALEDONIA. Grande Terre: Tao Falls, 20°36'S, 164°47'E, 10-15 m, on *Casuarina* in wet gully, *S. Louwhoff 907, 908 & J-M. Porigneaux*, 2.vii.1999 (CANB); Mt Koghis, track to communications tower, 22°13'S, 166°32'E, 500 m, on vine in wet forest, *S. Louwhoff 1042 & J-M. Porigneaux*, 6.vii.1999 (CANB).

Parmotrema sarrameanum Louwhoff & Elix, sp. nov. Fig. 5

Thallus ut in *Parmotrema endosulphureum* sed acidum gyrophoricum noncontinente differt.

Type: New Caledonia. Grande Terre: Sarraméa, 21°42'S, 165°50'E, *ca.* 300 m, on *Albizia* in agricultural land at head of valley bordering wet forest, *S. Louwhoff 776 & J-M. Porigneaux*, 29 June 1999; holo PC; iso: CANB.

Thallus foliose, moderately to loosely adnate, membranaceous or occasionally becoming coriaceous, 6-15 cm wide. *Lobes* subirregular, rounded at apices, 0.4-0.8(-1.2) cm wide; margins entire or irregularly incised, occasionally ±sinuous, eciliate with a thin, dark brown margin. *Upper surface* faint yellow-green with a bluish hue, undulating, smooth becoming ±rugulose, emaculate, isidiate; isidia moderately dense, laminal to submarginal, cylindrical, mostly simple, occasionally branching, up to 0.3 mm high, apices brown, syncorticate. Medulla yellow throughout. *Lower surface* black, shiny, rugulose, with a brown, erhizinate marginal zone; rhizines moderately dense, occurring in scattered clusters, simple, black, up to 0.6 mm long. *Apothecia* and *pycnidia* not seen.

Chemistry. Cortex K+ yellow; medulla K-, C-, KC-, P-; containing atranorin (minor), chloroatranorin (major), eumitrin N1 (major), eumitrin N2 (minor), eumitrin N3 (minor), eumitrin N7 (minor) and eumitrin N4 (trace).

Parmotrema sarrameanum is characterized by the laminal isidia and the yellow medulla due to the presence of medullary eumitrins N1, N2, N3, N4 and N7. This new species closely resembles *Parmotrema endosulphureum* (Hillm.) Hale in both morphology and chemistry, but it can be distinguished by the lack of gyrophoric acid. The relationship between *P. endosulphureum* and *P. sarrameanum* is similar to that between *P. sipmanii* Louwhoff & Elix and *P. kurokawianum* Louwhoff & Elix. The latter two species contain eumitrins in the A group rather than the N group (Louwhoff & Elix 1999). Of the four taxa, *P. endosulphureum* is most widespread (Neotropical/Pacific), whereas *P. kurokawianum* is known from Fiji and Papua New Guinea, *P. sipmanii* from Papua New Guinea (Louwhoff & Elix 1999) and *P. sarrameanum* from New Caledonia. At present the significance of the apparent parallels between the four taxa is not known. *Parmotrema sarrameanum* was collected from bark and rock in exposed situations from sea level and approximately 300-400 m altitude.

Paratype Specimens Examined

NEW CALEDONIA. Grande Terre: Sarraméa, 21°42'S, 165°50'E, 300-400 m, on mossy rock and tree trunk, *S. Louwhoff 774, 778 & J-M. Porigneaux*, 29.vi.1999 (CANB); Touaoura, near Yaté, 22°14'S, 166°52'E, 1 m, on coastal tree, *S. Louwhoff 1078 & J-M. Porigneaux*, 6.vii.1999 (CANB).

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BENJAMINIOMYCES, A NEW NAME FOR BENJAMINELLA, AND CORRECTIONS OF PUBLISHED ERRORS IN LABOULBENIALES

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ABSTRACT

A new name, *Benjaminiomyces*, is proposed for *Benjaminella*, regarded as a later homonym of *Benjaminiella*. The taxonomic positions of *Benjaminiomyces*, *Rhadinomyces*, *Tavaresiella*, and *Triceromyces* are indicated, as well as the original taxonomic disposition of *Aphanandromyces*.

Key words—*Aphanandromyces, Benjaminella, Benjaminiomyces, Diplomyces, Majewskia, Rhadinomyces, Tavaresiella, Triceromyces*, Laboulbeniales

As part of a taxonomic revision of the Laboulbeniales, many apparently unrelated species were removed from some large genera and several new genera were proposed (see Tavares, 1981, 1985; Tavares and Majewski, 1976). These changes included the transfer of four Argentinian species of Laboulbeniales from *Rickia* to the new genus *Benjaminella* I. I. Tav.

All known genera were arranged in families, subfamilies, tribes, and subtribes by Tavares (1985). The taxonomic position of some of these genera, however, has been overlooked or misconstrued in several authoritative publications (Eriksson and Hawksworth, 1986a, 1986b, 1987a, 1987b, 1988, 1993, 1995, 1996, 1998; Hawksworth et al., 1995; also see Eriksson, 1984, Eriksson and Hawksworth, 1985).

THE CORRECT NAMES FOR THE FOUR ARGENTINIAN TAXA

At the time that Spegazzini (1917) described *Rickia perpusilla, R. platensis,* and *R. pumila,* he emphasized their hyaline thalli, as contrasted to those of typical species of *Rickia*, which are characterized by conspicuous dark septa on distinctive appendages. However, he did not compare them to *Rickia melanophthalmae* Thaxter (1912), perhaps because there was little in the wording of Thaxter's unillustrated description that would emphasize their similarity. However, this similarity, in drawings and descriptions, was noticed by Thaxter (1926, p. 506; 1931, pp. 53–55), who indicated that the four species should be placed in a new genus.

Shortly before the publication of *Benjaminella* (Tavares, 1981 [17 March 1981]) to accommodate these four species, the genus *Benjaminiella* Arx was published in the Mucorales (Arx, 1981, 20 February, 1981; date given by Eriksson and Hawksworth, 1986a, p. 122]). The similarity of spelling of these two genera was indicated in 1982 with the months of publication and no other comment (*CMI Index of Fungi* 5:74. 1982). In *Ainsworth & Bisby's Dictionary of the Fungi* of 1983 (Hawksworth et al., 1983, p. 51), both genera were listed without comment, only the year 1981 being given. However, in 1986 Eriksson and Hawksworth (1986a, p. 122, item 31) published the following statement: "These names are so similar that they are likely to be confused, and they should be treated as homonyms..." The name *Benjaminiomyces* is herein proposed as a new name for *Benjaminella* I. I. Tav. (*Mycotaxon* 12: 432. 1981).

Benjaminiomyces, nom. nov.

Type: **Benjaminiomyces melanophthalmae** (Thaxt.) comb. nov.

Basionym: *Rickia melanophthalmae* Thaxt. (Thaxter, 1912, p. 161), on elytra of *Melanophthalma* sp. (Lathridiidae), Escuela Regional de Santa Catalina, south of Buenos Aires, Argentina (IV.1906) (*Thaxter no. 1980*) Holotype slide *2975* (FH).

Synonym: *Benjaminella melanophthalmae* (Thaxt.) I. I. Tav. (Tavares, 1981, p. 433).

Other species:

Benjaminiomyces perpusilla (Speg.) comb. nov.

Basionym: *Rickia perpusilla* Speg. (Spegazzini, 1917, p. 666), on elytra of *Phalacrus* sp.? (Phalacridae) (Slide labelled 367-1915, X.1915, Santa Catalina, Argentina, is here designated as the lectotype)(*LPS 38700*). In the protologue, Spegazzini (1917) stated that the collections were made at Santa Catalina, Buenos Aires and in La Plata in winter, 1915. Thaxter (1931) in the legend for pl. LIII, fig. 3, labelled as "Type of Spegazzini" a specimen that bears a vague resemblance to the left-hand drawing in Spegazzini's fig. 197 (1917). The specimen shown in Thaxter's pl. LIII, fig. 3 apparently is on Spegazzini's slide 367-1915 (Benjamin, personal communication). Although this slide (367-1915) was not labelled "type," it should be regarded as the lectotype slide. Thaxter's pl. LIII, fig 4 (said by Thaxter, 1931, p. 428, to have been drawn from the type preparation) may represent another specimen on slide 367-1915. Tavares (1981) published a photograph from slide 367-1915 (pl. 1, fig. i) that resembles somewhat fig. 197, right (Spegazzini, 1917).

Synonym: *Benjaminella perpusilla* (Speg.) I. I. Tav. (Tavares, 1981, p. 436).

Benjaminiomyces platensis (Speg.) comb. nov.

Basionym: *Rickia platensis* Speg. (Spegazzini, 1917, p. 667), on elytra of *Europs vicinus* Grouvelle (Rhizophagidae, subfamily Monotominae, which is sometimes put in the Cucujidae), Escuela Regional de Santa Catalina, Argentina, 3.X.1915. Holotype slide 313-1915 [*LPS 38701*]. Thaxter (1931), in his legend for Pl. LIII labelled fig. 1 as representing the mature type of Spegazzini; this specimen is on slide 313-1915 (labelled "typus") together with the thalli shown by Tavares (1981) in Pl. 1, figs. g, h; fig. h was inadvertently labelled as lectotype (fig. g shows the specimen in Pl. LIII, fig. 2).

Synonym: *Benjaminella platensis* (Speg.) I. I. Tav. (Tavares, 1981, p. 437).

Benjaminiomyces pumila (Speg.) comb. nov.

Basionym: *Rickia pumila* Speg. (Spegazzini, 1917, p. 668), on elytra of *Sacium* sp.? (Corylophidae), Escuela Regional de Santa Catalina, X.1915. Slide 370-1915 is here designated as the lectotype (*LPS 38699*). The slide was not marked as type. Thaxter (1931) indicated that Pl. LIII, fig. 8, was from the type preparation of Spegazzini; this is one of the specimens shown in Tavares (1981; pl. 1, fig. k). Thaxter (1931) apparently overlooked the specimen shown in my pl. 1, fig. l, which conceivably might be the thallus at left in Spegazzini's fig. 199.

Synonym: *Benjaminella pumila* (Speg.) I. I. Tav. (Tavares, 1981, p. 437).

CORRECTIONS OF ERRORS IN LABOULBENIALES ENTRIES AND COMMENTS

The classification of the Laboulbeniales outlined by Tavares (1985) was based primarily on perithecial characters and the relation of the perithecial stalk cells to the primary axis of the thallus. As a rule, the familial position of a specimen can be established by careful examination of a thallus with an immature perithecium.

An enumeration of all known genera was included in Tavares (1985), together with their taxonomic positions. The following notes are based mostly on this publication.

Benjaminella was stated to be in the Laboulbeniinae, Laboulbeniaceae, Teratomyceteae, Rhipidiomycetinae. There was never any doubt expressed about its placement in Laboulbeniaceae. The entry for *Benjaminella* in *Ainsworth & Bisby's Dictionary of the Fungi, Eighth Edition* (Hawksworth et al., 1995) listed it as Laboulbeniales (inc. sed.) and gave a reference: Eriksson and Hawksworth, *Systema Ascomycetum* 5:122. 1986, which referred to the homonym problem; in generic lists (Eriksson and Hawksworth, 1986b, 1998), *Benjaminella* was included in the Laboulbeniaceae.

In *Ainsworth & Bisby's Dictionary of the Fungi, Seventh Edition* (Hawksworth et al., 1983), for which I reviewed entries, only the order Laboulbeniales was listed, not the families. In the *Eighth Edition* (Hawksworth et al., 1995), for which I did not review entries, families were added and a number of errors appeared. These flawed 1995 entries will be dealt with in alphabetical order below, with comments on related entries in *Systema Ascomycetum* volumes.

Acompsomyces: change page number from 20 to 210.

Aphanandromyces: correctly placed, but unfortunately with a reference to a confusing comment concerning its taxonomic position (Eriksson and Hawksworth, 1987a, p. 114)—"W. Rossi (in litt., 19.I.1987) has informed us that he now considers the genus *Aphanandromyces* a member of the Laboulbeniaceae. It was originally placed in Herpomycetaceae." Rossi (1982) clearly stated that the new genus, *Aphanandromyces*, was included in Stigmatomyceteae (Thaxter's classification of 1908) and it was included in the same group within the Laboulbeniaceae by Tavares (1985). In *Systema Ascomycetum* (Eriksson, 1984, p. 25; Eriksson and Hawksworth, 1985, p. 27, 1986b, p. 230) *Aphanandromyces* and *Herpomyces* were both listed in Herpomycetaceae. The reason for inclusion of *Aphanandromyces* was not indicated. It was later removed to Laboulbeniaceae (Eriksson and Hawksworth, 1987b, p. 287), but the deceptive remark remains (Hawksworth et al., 1995) that suggests that its taxonomic position had been changed from the author's original disposition.

Aporomyces: Staphylinidae is correct spelling.

Benjaminella: see above

Diplomyces: listed with a query before Laboulbeniales. The source of this query is not indicated. The question mark was placed before *Diplomyces* in the generic list of Laboulbeniaceae (Eriksson, 1984, p. 27; Eriksson and Hawksworth, 1993, p. 85); Hawksworth et al. (1995) referred to Rossi and Cesari Rossi (1978), and to Benjamin (1983), who did not specifically mention the family; in the latter, at least, there was a clear indication of relationships in the discussion. Tavares (1985) listed *Diplomyces* in Laboulbenieae in the Laboulbeniaceae.

Jeanneliomyces: misspelled

Majewskia: a reference is made to Eriksson and Hawksworth (*Systema Ascomycetum* 7:79 [as 78]. 1988). The entry for *Majewskia* Y.B. Lee stated that the description of the genus published in Lee, 1986:108 was issued 16 June 1986 and thus preceded the description of the genus in Lee and Sugiyama, 1986: 289, which bore the date August 1986. The dates given are erroneous. Lee, *Korean Journal of Plant Taxonomy* 16(2): 89–105, is dated August, 1986 and Lee and Sugiyama, *Mycologia* 78(2): 289–292 is dated 15 April 1986 (the May-June issue [no. 3] of *Mycologia* was dated 16 June 1986 and it is supposed that somehow this became mistakenly entered for Lee, 1986). The listing, *Majewskia* Y.B. Lee & K. Sugiy., was corrected (Eriksson and Hawksworth, 1988b, p. 152), but the erroneous citation was still included in Hawksworth et al. (1995), without any correction or explanation.

Rhadinomyces: this is given as a synonym of *Rhachomyces*. Tavares (1985) listed *Rhadinomyces* in the Laboulbenieae, Stigmatomycetinae, and *Rhachomyces* in Laboulbeniaceae, Teratomyceteae, Rhachomycetinae. Eriksson (1984, p. 28) omitted both *Rhachomyces* and *Rhadinomyces* from a horizontally arranged listing; later Eriksson and Hawksworth (1985, p. 30) added *Rhachomyces*. It might be assumed that the inclusion of *Rhadinomyces* as a synonym of *Rhachomyces* resulted from the erroneous indentation of *Rhadinomyces* in a vertically arranged list (Eriksson and Hawksworth, 1986b, p. 238). The two genera were separate entries in *Ainsworth & Bisby's Dictionary of the Fungi, Seventh Edition* (Hawksworth et al., 1983).

Tavaresiella: listed as Laboulbeniales *incertae sedis* (Eriksson and Hawksworth, 1987b, p. 320). In 1996 (Eriksson and Hawksworth, 1996, p. 147) it is again so listed, with a reference to Eriksson and Hawksworth (1995, p. 69), where a reference was made to Benjamin (1993). In his monograph of *Tavaresiella*, Benjamin (1993) stated that the genus is in the

Laboulbeniaceae, as did Tavares (1985), and this opinion is not contrary to the statements made by Majewski (1981) about its relationships. Nevertheless, *Ainsworth & Bisby's Dictionary of the Fungi, Eighth Edition* (Hawksworth et al., 1995) listed *Tavaresiella* as ?Laboulbeniales. The cited literature on this genus certainly does not provide a reason for such an indication of doubt regarding taxonomic position.

Triceromyces: listed in the *Eighth Edition* (Hawksworth et al., 1995) as Laboulbeniales (*inc. sed.*), despite the reference to Benjamin (1986) where it is clearly indicated that *Triceromyces* is in the Stigmatomycetinae, Laboulbenieae, Laboulbeniaceae, as also stated in Tavares (1985). *Triceromyces* was included in the list under Laboulbeniales *inc. sed.* in Eriksson and Hawksworth (1993, p. 121).

In addition to errors in Hawksworth et al., 1995, the author error in Eriksson and Hawksworth (1998) should be mentioned for *Heimatomyces* Peyritsch (syn. of *Chitonomyces* Peyritsch) and *Helminthophana* Peyritsch (syn. of *Arthrorhynchus* Kolenati). These authors are given as Peyronel.

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TREMATOSPHAERIA CIRCINANS ON MEDICAGO SATIVA IN TURKEY

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Trematosphaeria circinans on *Medicago sativa,* a new fungus species for Turkish mycoflora, is described and illustrated.

Key words: Alfalfa, *Trematosphaeria circinans*, Turkey

During the summer of 1997-1998, a disease has been observed on alfalfa (*Medicago sativa* L.) plants in Erzurum, Turkey. Disease were observed as pseudothecia on the roots and crowns of two year and/or older plants. The causal agent of the disease was identified as *Trematosphaeria circinans* (Sacc.) Winter (Ellis and Ellis, 1985). The collections concerned are characterized as follows: Pseudothecia pyriform, with base immersed, black, (300-) 330 (-365) µm diameter, with a narrow short ostiolar beak (Figure 1). Ascospores ellipsoidal, slightly curved, 3-septate, (27-) 30 (-33) x (10-) 11 (-13) µm, median cells dark brown and larger than the end cells, end cells almost hyaline (Figure 2). Ascospore walls are smooth to finely warted and are constricted at the septa, most prominently at the central septum (Figure 2).

Alfalfa, *Helianthemum* spp. and *Ligustrum* spp. has been known as host species of *Trematosphaeria circinans* in Europe (Holm,1957). *Trematosphaeria circinans* on alfalfa has been reported from North America (Semeniuk, 1983). This is the first report of *Trematosphaeria circinans* from Turkey.

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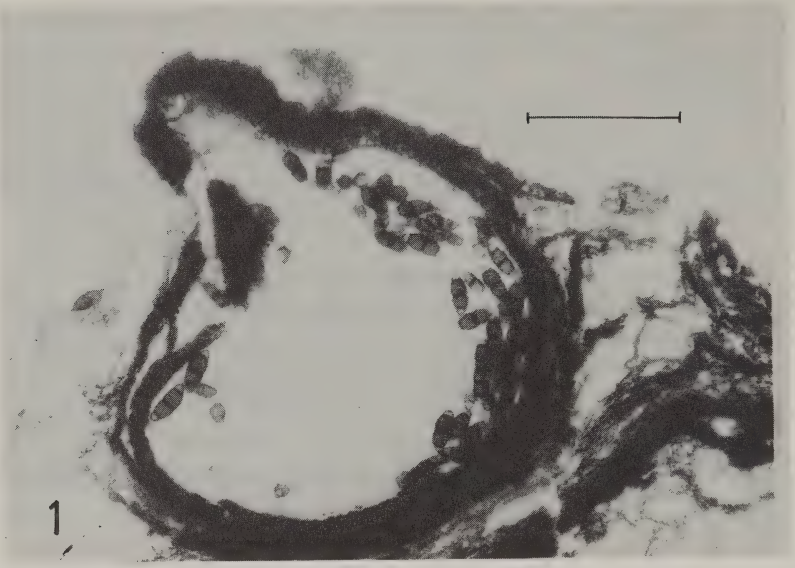

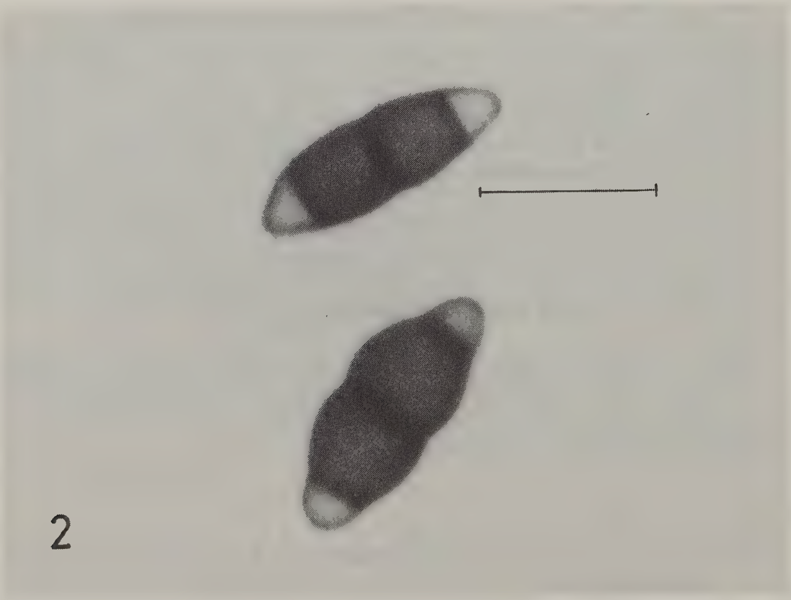

Figure 1. Pseudothecia of *Trematosphaeria circinans* (Bar = 100 µm). Figure 2. Ascospores of *Trematosphaeria circinans* (Bar = 20 µm).

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NOTES ON SOME JAPANESE SMUT FUNGI. I. UROCYSTIS RODGERSIAE[1]

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ABSTRACT

A new combination of *Tuburcinia rodgersiae* (Ustilaginomycetes) on *Rodgersia aesculifolia* and *R. podophylla* (Saxifragaceae) is proposed. The fungus is described and illustrated.

KEYWORDS: fungi of Japan, smut fungi, taxonomy, *Urocystis*, Ustilaginomycetes.

The name *Urocystis rodgersiae* appeared for the first time in three schedulae of Prof. Kingo Miyabe (SAPA Herbarium). Because this name was not published by Miyabe, Ito (1935: 96) described this fungus as "*Tuburcinia Rodgersiae* (Miyabe) Miyabe, comb. nov. (*Urocystis Rodgersiae* Miyabe in sched.)" giving a Latin diagnosis, and indicating also a type [Mt. Yudono-yama, Prov. Uzen (Yamagata Pref.), Japan, K. Miura, 14 Aug. 1905]. The new combination is based on an illegitimate name. However, *Tuburcinia rodgersiae* was validly described by Ito (1935: 96).

Guo (1988: 269) published this fungus under the name of *Urocystis rodgersiae* (Miyabe) Miyabe ex Zundel. It is incorrect, because the description in Zundel (1953: 332) does not constitute a valid publication. It was only the use of the invalid name *U. rodgersiae* (Miyabe) Miyabe. If we presume, according to Guo (l.c.), that the aim of Zundel was to create a new combination, the last one must be accepted also as an illegitimate name (ICBN, Art. 35.1).

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[1] Contribution no. 146 of the Laboratory of Plant Pathology and Mycology, Institute of Agriculture and Forestry, University of Tsukuba, Japan.

We propose here a new combination of *Tuburcinia rodgersiae* Miyabe ex S. Ito.

MATERIALS AND METHODS

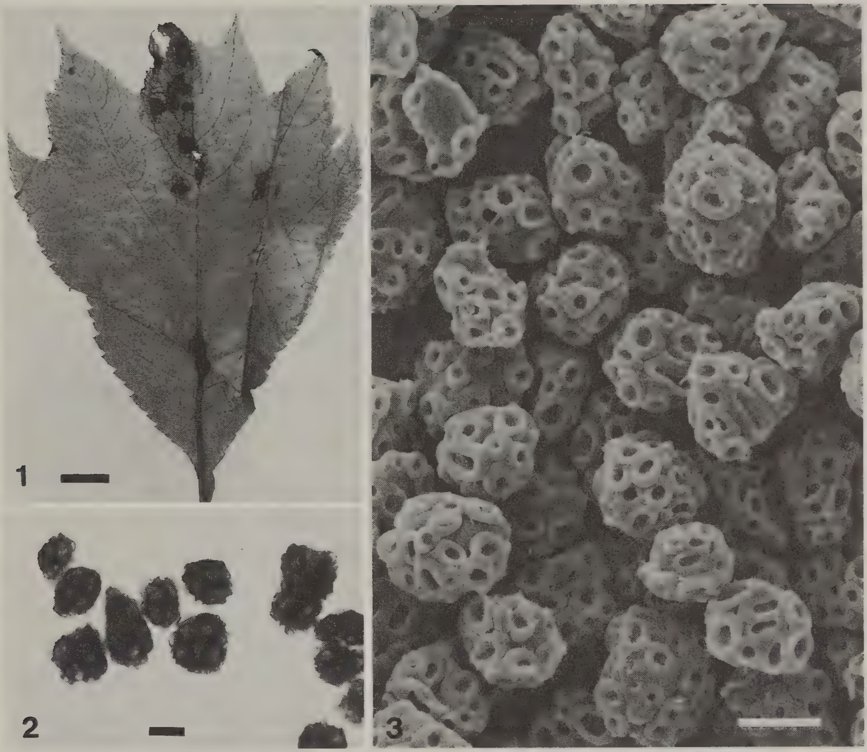
Herbarium material from the collections of Hokkaido University, Sapporo (SAPA) and Hirosaki University was examined under a light microscope after mounting in lactophenol, gently heating to the boiling point, and then cooling. The measurements of ustilospores are given in the form: min–max (mean ± 1 standard deviation). In the description, a symbol 'n/$_x$=' is used to indicate the total numbers of measured collections, and spore balls or ustilospores, respectively. The surface ultrastructure of ustilospores was observed and photographed with a Hitachi S-4200 Scanning Electron Microscope.

NEW COMBINATION PROPOSED

Urocystis rodgersiae* (Miyabe ex S. Ito) Denchev & Kakishima,** ***comb. nov.
Basionym: *Tuburcinia rodgersiae* Miyabe ex S. Ito, Trans. Sapporo Nat. Hist. Soc., **14:** 96, 1935.
[= *Urocystis rodgersiae* Miyabe in sched. (nom. inval.)]

Sori as fusiform, 5–10 mm long swellings in the petioles, initially covered by the epidermis which ruptures exposing the spore balls, or in the leaf veins, hypophyllous, at first (May–June) branched into the veins and covered by the swollen epidermis, later (July–August) rupturing the epidermis and exposing the spore balls, often confluent after rupturing the epidermis, suborbicular, broadly elliptical, elliptical or ovate in general outline, 4–20 mm long, in the middle vein elongate up to 30 mm, forming small to large (up to 11 cm long), reddish or reddish-brown spots on the upper leaf surface, or flesh, vinaceous or livid vinaceous spots on the under leaf surface. **Spore mass** powdery, black. **Spore balls** subglobose, broadly ellipsoidal, ellipsoidal or ovoid, 21–70 × 18–51 μm, composed of (1–) 2–6 (–9) central ustilospores [1=3%, 2=18%, 3=28%, 4=27%, 5=12%, 6=7.5%, 7=2%, 8=1%, 9=0.5%; n/$_6$=745], surrounded by a discontinuous or almost continuous layer of sterile cells. **Sterile cells** suborbicular, broadly elliptical or elliptical in outline, or collapsed, 5.5–12 (–14) μm long, light yellowish, smooth. **Ustilospores** subglobose, broadly ellipsoidal, ovoid or irregularly angular, 12–21 × 9–15.5 (15.0±1.6 × 11.9±1.1) μm (n/$_5$=258), dark reddish-brown; wall 0.9–1.2 (–1.4) μm thick, smooth (Figs.1-3).

Specimens examined. On *Rodgersia podophylla* A. Gray: JAPAN: Yamagata Pref. (Prov. Uzen), Asahi-mura, Mt. Yudono-yama, 14.VIII.1905, K. Miura (SAPA, holotype); Yamagata Pref., Asahi-mura, Mt. Yudono-yama, 8.VIII.1901, G. Yamada (SAPA, paratype); Iwate Pref., Mt. Kurikoma, 3.VIII.1908, G. Yamada (SAPA, paratype); Aomori Pref., Nishitsugaru-gun, Ajigasawa-machi, 3.VI.1973, Y. Harada



Figs. 1–3. *Urocystis rodgersiae* (Miyabe ex S. Ito) Denchev & Kakishima on *Rodgersia podophylla* A. Gray (Holotype, SAPA). – Fig. 1. Sori. Bar = 2 cm. – Fig. 2. Spore balls in LM. Bar = 20 µm. – Fig. 3. Spore balls in SEM. Bar = 20 µm.

(Herb. Hirosaki Univ., 4389); Aomori Pref., Nishitsugaru-gun, Fukaura-machi, 16.V.1976, Y. Harada (Herb. Hirosaki Univ., 4390); Aomori Pref., Kitatsugaru-gun, Shiura-mura, 2.VI.1978, Y. Harada (Herb. Hirosaki Univ., 15192); 14.VI.1981, Y. Harada (Herb. Hirosaki Univ., 11633); Aomori Pref., Kitatsugaru-gun, Kodomari-mura, 14.VI.1981, Y. Harada (Herb. Hirosaki Univ., 11607, 11631, 11632, 11635); Aomori Pref., Shimokita-gun, Oma-machi, 3.VI.1984, Y. Harada (Herb. Hirosaki Univ., 14764); Aomori Pref., Nishitsugaru-gun, Ajigasawa-machi, 5.VI.1989, Y. Harada (Herb. Hirosaki Univ., 19328).

Hosts and distribution.

On *Rodgersia aesculifolia* Batal.: China, Yunnan Province (Guo, 1988).
On *R. podophylla* A. Gray: Japan, Honshu.

ACKNOWLEDGEMENTS

We wish to express our thanks to Dr. K. Vánky (Tübingen, Germany) and Dr. R. T. Moore (School of Applied Biological and Chemical Sciences, University of Ulster, UK) for critically reading the manuscript and helpful discussion. We are also grateful to Prof. Y. Harada (Hirosaki University) and Prof. I. Uyeda, the Curator of SAPA (Herbarium of Hokkaido University, Sapporo) for the loan of the cited specimens. The study was supported by the Japan Society for the Promotion of Science.

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NOTES ON SOME JAPANESE SMUT FUNGI. II. UROCYSTIS ON SCILLA[1]

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ABSTRACT

The name *Urocystis scillae* (Ustilaginomycetes) on *Scilla autumnalis* and *S. bifolia* from Europe and North Africa is validated. *Urocystis scilloides* on *Scilla scilloides*, previously known from Japan as *U. scillae*, is described and illustrated as a new species.

KEYWORDS: fungi of Japan, smut fungi, taxonomy, *Urocystis*, Ustilaginomycetes.

In 1938 Ciferri (1938: 130) validly described a new smut fungus on the leaves of *Scilla bifolia*, namely *Tuburcinia scillae*. Because the correct place of this taxon is in the genus *Urocystis*, a new combination, *Urocystis scillae*, was proposed by Zundel (1953: 333). However, the cited basionym of this combination, viz. *U. colchici* Fuckel (1869), *pro parte*, is not a correct one. In accordance with the ICBN (Arts. 33.2 & 33.3) this combination is illegitimate. Later Săvulescu (1955: 80; 1957: 1070) proposed another combination, *Urocystis scillae* (Cif.) Săvul., but in the both cited references this name is again illegitimate. In the paper of Săvulescu (1955) the name was without basionym (ICBN, Art. 33.2) while in the second place it was without any indication for a new combination (ICBN, Art. 35.1), on the contrary, that name was based on the previous illegitimate combination. *Urocystis* on *Scilla* is currently represented by *Urocystis scillae* recorded in the literature from Europe, North Africa and Japan (Ito, 1936, 1938; Ciferri, 1938, 1963; Zundel, 1953; Kakishima, 1982; Vánky, 1994; etc.). The objectives of this article are to: (i) validate the name of *Urocystis scillae*; and (ii) describe a new species, based on the Japanese specimens of *Urocystis* on *Scilla scilloides*.

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[1] Contribution no. 147 of the Laboratory of Plant Pathology and Mycology, Institute of Agriculture and Forestry, University of Tsukuba, Japan.

MATERIALS AND METHODS

Herbarium material from the collections of University of Tsukuba, Tsukuba (TSH) and Hokkaido University, Sapporo (SAPA) was examined under a light microscope after mounting in lactophenol, gently heating to the boiling point, and then cooling. The measurements of ustilospores are given in the form: min–max (mean ± 1 standard deviation). In the description, a symbol ‘n/$_{x}$=’ is used to indicate the total numbers of measured collections, and spore balls or ustilospores, respectively. The surface ultrastructure of ustilospores was observed and photographed with a Hitachi S-4200 Scanning Electron Microscope.

NOMENCLATURE OF *UROCYSTIS* ON *SCILLA*

Urocystis scillae **(Cif.) Denchev & Kakishima,** ***comb. nov.***

Basionym: *Tuburcinia scillae* Cif., Fl. Italica Crypt., Pars I, Fungi, Fasc., **17:** 130, 1938.
[= *Tuburcinia scillae* Cif., Atti Ist. Bot. Univ. Pavia, Ser. 3, **1:** 79, 1924 (nom. nud.)]
[= *Urocystis scillae* (Cif.) Zundel, Pennsylvania State Coll. School Agric. Dept. Bot., Contrib., **176:** 333, 1953 (nom. illeg., ICBN, Arts. 33.2 & 33.3)]
[= *Urocystis scillae* (Cif.) Sǎvul., Ustilaginales der Rumänischen Volksrepublik, p. 80, 1955 (nom. illeg., ICBN, Art. 33.2)]
[= *Tuburcinia colchici* (Schlecht.) Liro [...] *scillae* (Cif.) Cif., Quaderno, **27:** 287, 1963 (nom. illeg., ICBN, Art. 35.1)]

Hosts and distribution.

On *Scilla autumnalis* L.: Central and South Europe[1], and North Africa (Tunis).
On *S. bifolia* L.: Europe.

TAXONOMY OF JAPANESE SPECIMENS OF *UROCYSTIS* ON *SCILLA*

Besides European and North African records, *Urocystis scillae* has also been reported for Japan (Ito, 1935, 1936, 1938; Kakishima, 1982). However, there is a distinct discreteness in the morphometrical variability, especially regarding the distribution of fertile spore number per spore ball and measurements of ustilospores between the Japanese smut fungus on *Scilla scilloides* and European *Urocystis scillae*. The Japanese smut fungus has a higher proportion of few-spored spore balls [composed of 1–2 (–4) fertile spores per spore ball] and larger ustilospores (12–23.5 × 10–17.5 μm), while *Urocystis scillae* was originally described as possessing (1–) 2–4 (–5) ustilospores per spore ball and ustilospores 8–16 μm in diameter (Ciferri, 1938, 1963). Therefore we are describing a new species of *Urocystis* on *Scilla scilloides* from Japan.

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[1] The records for Sweden (Zundel, 1953) and Russia (Savulescu, 1957; Ciferri, 1963) are erroneous ones (see Lindeberg, 1959: 80; Azbukina & Karatygin, 1995: 218).

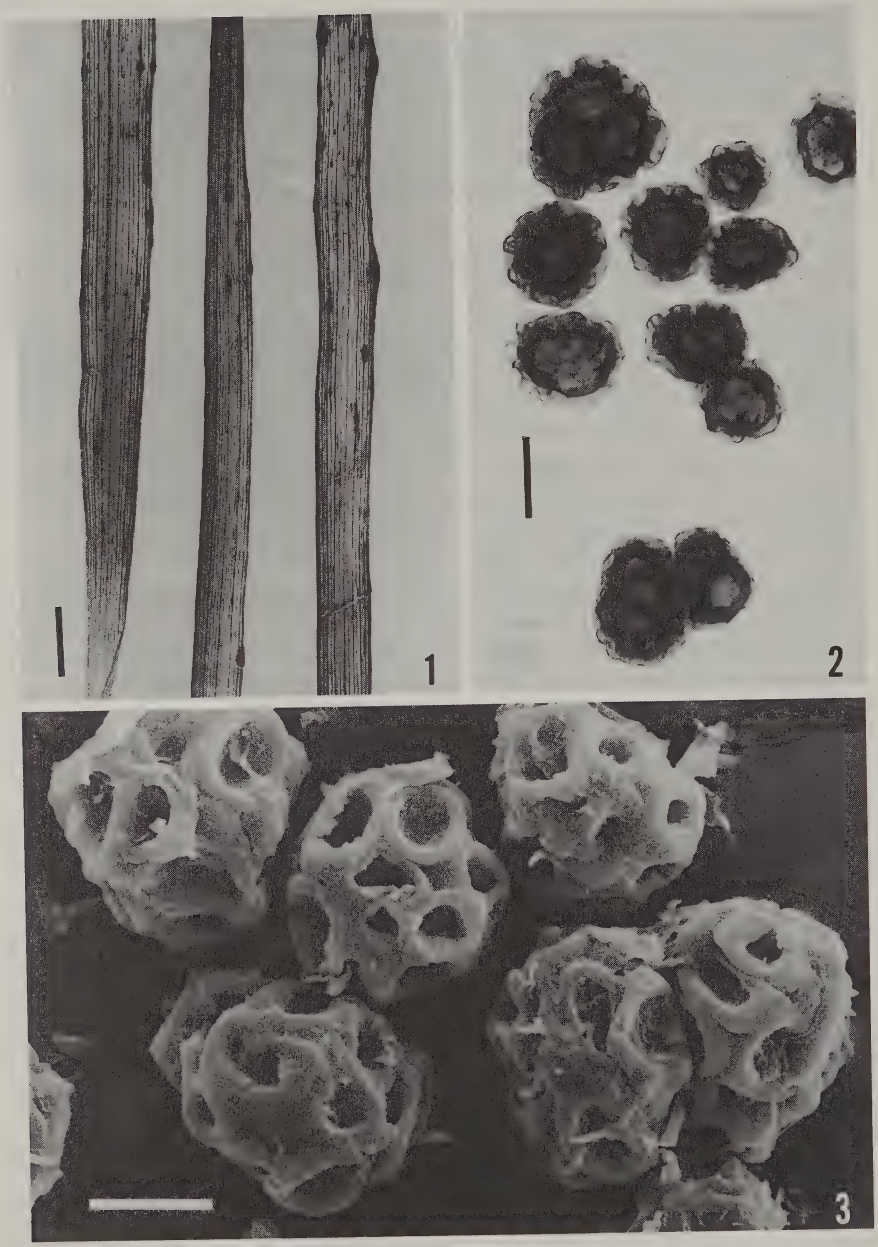
Urocystis scilloides **Denchev & Kakishima,** ***sp. nov.***

Holotypus: in foliis *Scillae scilloidis* (Lindl.) Druce, Japan, Honshu, Tottori Pref., Yadani, near Tottori, 4.V.1930, N. Hiratsuka (TSH-S403). Isotypus in SAPA. Paratypus: Japan, Honshu, Saitama Pref., Tajimaga-hara, 1.V.1952, S. Sato (TSH-S402).

Sori in foliis tumores fusiformes vel ovates, 0.5–4 mm longae formati, primo lividi, epidermide tecti. **Massa sporarum** nigra, pulverea. **Glomeruli sporarum** globosi, subglobosi, late ellipsoidei, ellipsoidei vel ovoidei, e ustilosporis 1–2 (–4) compositi [sporae glomerulorum sporarum: 1=48%, 2=40%, 3=10%, 4=2%; $n/_3$=1000], strato subperfecto, cum exceptione perfecto cellularum sterilium circumdati; 19–27 × 19–24.5 μm [e 1 ustilospora compositi], 29–35 × 22–28 μm [e 2 ustilosporis compositi]. **Cellulae steriles** suborbiculares, late ellipticae, ellipticae, ovate vel collapsae, 5–12.5 μm longae, flavobrunneae, leves. **Ustilosporae** globosae, subglobosae, late ellipsoideae, ovoideae vel irregulariter angulares, 12–23.5 × 10–17.5 (17.1±2.0 × 13.8±1.4) μm ($n/_3$=161), atro-rufobrunneae, cum exceptione rufobrunneae, leves.

Sori in the leaves, forming fusiform or ovate, 0.5–4 mm long swellings at first lead-coloured and covered by the epidermis which ruptures to expose the spore balls. **Spore mass** powdery, black. **Spore balls** globose, subglobose, broadly ellipsoidal, ellipsoidal or ovoid, composed of 1–2 (–4) central ustilospores [1=48%, 2=40%, 3=10%, 4=2%; $n/_3$=1000], surrounded by an almost continuous, sometimes continuous layer of sterile cells; 19–27 × 19–24.5 μm [when composed of 1 ustilospore], 29–35 × 22–28 μm [when composed of 2 ustilospores]. **Sterile cells** suborbicular, broadly elliptical, elliptical or ovate in outline, or collapsed, 5–12.5 μm long, yellowish-brown, smooth. **Ustilospores** globose, subglobose, broadly ellipsoidal, ovoid or irregularly angular, 12–23.5 × 10–17.5 (17.1±2.0 × 13.8±1.4) μm ($n/_3$=161), dark reddish-brown, sometimes middle reddish-brown, smooth (Figs. 1–3).

Specimens examined. On *Scilla scilloides* (Lindl.) Druce: JAPAN: Honshu, Tottori Pref., Yadani, near Tottori, 4.V.1930, N. Hiratsuka, TSH-S403 [as *Tuburcinia hypogaea* (Körn.) S. Ito on *Scilla thunbergii*] (holotype); SAPA (as *Urocystis ornithogali* Körn.) (isotype); Honshu, Saitama Pref., Tajimaga-hara, 1.V.1952, S. Sato, TSH-S402 (as *Tuburcinia hypogaea* (Körn.) S. Ito on *Scilla thunbergii* Miyabe et Kudo) (paratype).



Figs. 1–3. *Urocystis scilloides* Denchev & Kakishima on *Scilla scilloides* (Lindl.) Druce (Holotype, TSH-S403). – Fig. 1. Sori. Bar = 1 cm. – Fig. 2. Spore balls in LM. Bar = 20 µm. – Fig. 3. Spore balls in SEM. Bar = 10 µm.

Host and distribution. On *Scilla scilloides* (Lindl.) Druce (*S. thunbergii* Miyabe & Kudo): Japan (Honshu).

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We wish to express our thanks to Dr. R. T. Moore (School of Applied Biological and Chemical Sciences, University of Ulster, UK) for critically reading the manuscript and helpful discussion. We are also grateful to Prof. I. Uyeda, the Curator of SAPA (Herbarium of Hokkaido University, Sapporo) for the loan of the cited specimen. The study was supported by the Japan Society for the Promotion of Science.

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MACKINTOSHIA, A NEW SEQUESTRATE BASIDIOMYCETE GENUS FROM ZIMBABWE

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Summary: A sequestrate fungus consumed by antelope and by Karanga people in Zimbabwe is described as a new species belonging to the new genus *Mackintoshia* (Basidiomycotina, Cortinariales). This genus shows affinities with the agaric *Galerina* based on spore characters. Its systematic position within the hypogeous Cortinariales and the symbiotic relationship with Cesalpinioideae trees as putative hosts are discussed.

Key-words: hypogeous fungus. false truffle, Cortinariaceae, *Mycoamaranthus*.

INTRODUCTION

Hypogeous macromycetes, sequestrate fungi and truffles, have only been occasionally studied in Southern Africa and consequently information on the occurrence of this group is scarce. Less than ten species are known from the region (Bottomley, 1948; Marasas and Trappe, 1973). In central Zimbabwe, a large, hypogeous macromycete is found growing in clusters in damp, sandy soil under two common trees in 'miombo' woodland: *Burkea africana* Hook. and *Brachystegia spiciformis* Benth. The local Karanga people unearth and eat this fungus that is called 'Matifi'. Although it is highly prized, it seems to be little known outside the Midlands Province of Zimbabwe. Apparently it is also consumed by a small antelope, the Grey Duiker (*Sylvicapra grimmia* L.), which uncovers it by digging with its forelegs.
This edible sequestrate fungus is an undescribed taxon for which a new genus is proposed.

Mackintoshia Pacioni & Sharp nov. gen.

Basidiomata subterranea, septis glebae gelatinosis cellisque repletis, sporis flavis-ochraceis, equaliter ellipticis, parietibus crassis, dextrinoidis et cyanophilis, levibus in specie typica, contento basidiorum, ubi presente, et cystidiorum flavo fortiter cyanophilo
Genus ad agaricum *Galerina* stricte relatum sporarum characterium causa.
Species typica: *Mackintoshia persica* Pacioni & Sharp
Robbie Mackintosh florae mycologicae zimbabwensis benemerito dedicatum.

Mackintoshia is characterized by basidiospores which are smooth, dextrinoid, strongly cyanophilic and rather thick-walled. These spore characters occur also in the agaricoid genus *Galerina* Earle (Kühner, 1980; Singer and Smith, 1946), but in the former the spores are statismosporic and do not have a visible reduction in wall thickness at the apex corresponding to the germ pore area. However, a good number of the species currently included in *Galerina* apparently lack a true germ pore. No other genera of Cortinariaceae Roze have thick-walled, dextrinoid and cyanophilic spores. In addition, the presence of cystidia and the absence of clamp connections also call to mind some *Galerina* species belonging to the subgenus *Tubariopsis* (Kühner) Smith & Singer. The *Mackintoshia* cystidia seem to belong to the chrysocystidia type, in fact for their thin walls and yellow highly staining content, they are very similar to those supposed typical of the family Strophariaceae Sing. & Smith. The idea of an in depth-study of the microchemical reactions of these cystidia was abandoned because the possible results might lend themselves to uncertain interpretations. Some species of the genus *Weraroa* Singer show cystidia quite similar to the ones found in *Mackintoshia*, Singer and Smith (1958) called them 'endocystidia', that is cystidioid bodies formed in the interior of the trama, and this term can be applied to the *Mackintoshia* cystidia as well.

This new genus seems indeed to add to our knowledge on the evolutionary line of a branch of the Cortinariaceae, where the agaric *Galerina* can be phylogenetically related to this sequestrate genus. Within this evolutionary line *Mackintoshia* is close to the monospecific genus *Mycoamaranthus* Castellano, Trappe & Malajczuk (1992), which shows several characters in common: peridial structure; viscid gleba; thick-walled, dextrinoid spores. *Mycoamaranthus auriorbis* Castellano, Trappe & Malajczuk is found in Queensland and Thailand. Another undescribed species is found in the miombo woodlands of Africa (Castellano, pers. com.). *Mycoamaranthus* differs from *Mackintoshia* by its: a) gleba that is without a columella and, usually, with a basal pad that sometimes is prolonged into a stipe-like base; b) mature spores that are spiny; and c) the absence of cystidia. Accordingly, *Mycoamaranthus auriorbis* and *Mackintoshia persica* are two distinct species, belonging to different, even though close, genera. Concerning their systematic position, the phylogenetic affinities suggest their inclusion among the Cortinariales Jülich.

Mackintoshia persica Pacioni & Sharp nov. sp.

Fig. 1

Basidiomatibus subterraneis subglobosis vel subpiriformis superne compressis et lobatis, 7-11 cm, cum basalibus rhyzomorphibus; peridiopelli pallida flava-ochracea, dein olivacea, prosenchymatosa, 200-250 µm deinde subtili, 50-80 µm, super stratum gelatinosum ; gleba olivacea sed interdum superne aurantiaca, molli et elastica, succulenta, septis gelatinosis cum cellis repletis; sporis flavis-ochraceis, levis, equaliter ellipticis, paene obovato-apiculatis, parietibus crassiusculis sine poro germinativo, dextrinoidis et cyanophilis, 8-12x5-7 µm; basidiis clavato-utriculatis, tetrasporeis, hyalinis vel cum flavo contento, 32-40x8-10 µm; cystidiis longe fusiformibus superne fere digitatis, plerumque cum denso flavo contento fortiter cyanophilo, 38-84x6-12 µm; tramis gelatinosis; hyphis contexti 3-8 µm; fibulis absentibus. Sapore tenui sed odore grato maturae persicae simili (inde nomen). Edulis.

Habitat in solo granitico sabuloso udo sub *Brachystegia* et *Burkea*, Africae australis aestate.

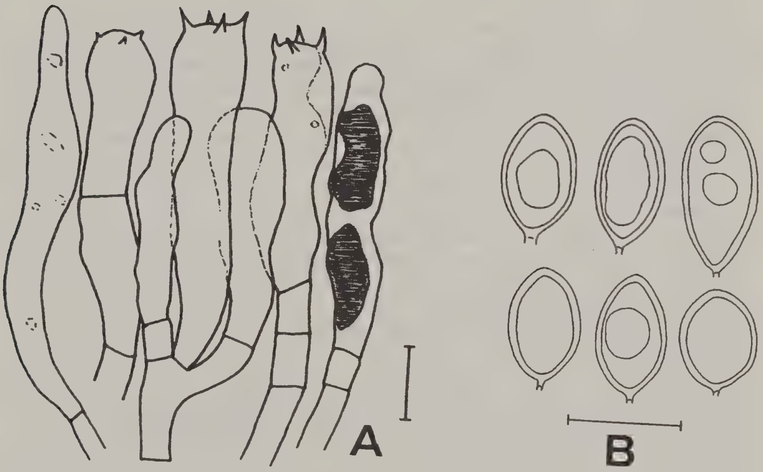
Holotypus: Zimbabwe, Makuti Ranch QDS 1930 A1, 6 January 1999, leg. J. Beckett and C. Sharp, CS1172/99 (AQUI).

Basidiomata hypogeous, subglobose or subpyriform, upper portion compressed and lobate, generally 7-11 cm. Peridiopellis pale yellow to orange-yellow with rusty cracks, then olivaceous, a trichoderm, on a thin gelatinous layer, with yellow hyphae 6-15 µm in diameter, in young specimens the layer is 200-250 µm thick, at complete maturity only 50-80 µm thick. Gleba white to pale ochraceous, then olivaceous, sometimes with upper part orange-yellow, soft and rubbery, fleshy, with gelatinous tramal plates and filled chambers at maturity. Spores elliptical, symmetrical, smooth, germ pore absent, thick-walled, pale ochraceous-yellow, dextrinoid, cyanophilic, 8-12 x 5-7 µm, average 9.35 ± 1.12 x 6.18 ± 0.45, Q= 1.52 ± 0.23. Basidia clavate-utriculate to utriculate, tetrasporic, rarely bisporic, hyaline or with a yellowish content, strongly cyanophilic, 32-40 x 8-10 µm, 5 µm in diameter at base, often with a basal, short 4-9 x 4-6 µm to cylindrical 18-21 x 4-6 µm, cell or directly arising from a branched element. Cystidia clavate to cylindrical, at maturity, elongate-fusiform, sometimes almost digitate in the upper portion, thin-walled, generally with a dense yellow, strongly cyanophilic content, 38-84 x 6-12 µm, 5 µm in diameter at base, easily collapsing with yellow-brown content almost crystallized. Trama 200-330 µm broad, of loosely interwoven hyphae, 3-8 µm in diameter, in a gelatinous matrix; hyaline with small, cyanophilic drops. Clamp connections absent.

Taste slight and pleasant, odor of ripe peach, (etymology '*persica*'). Edible.

Habitat in damp, granite soils beneath *Brachystegia* and *Burkea,* fruiting during austral summer.

Fig. 1 – *Mackintoshia persica* Pacioni & Sharp: A- hymenium ; B- spores (bars = 10 µm)



Collections studied: ZIMBABWE, Makuti Ranch QDS 1930 A1, emerging from sandy soil and litter under *Burkea africana*, 6 January 1999, leg. J. Beckett and C. Sharp, CS 1172/99 (**holotypus**, AQUI); Mvuma, Mtao Forest Reseve, Feb. 1985, leg. T. English, QDS 1930B3; Fairburn, near Felixburg, among *Brachystegia* and *Burkea africana* in poorly drained granite soils, 21 Jan. 1971, leg. R. Mackintosh, QDS 1930B4.

According to a record of R. Mackintosh, this species was found also in the Kalahari sands, 30 km east of Mtao Forest Reserve near the source of the Shashi River, beneath *Burkea*, and colored slides document its presence in Nerutanga Dam, under *Brachystegia spiciformis* and *Burkea africana* litter,· 16 Dec. 1992, but no vaucher is extant of this record, because the herbarium specimens, QDS 1931A4, were destroyed by rodents.

Sporocarps are soft because of the gelatinous tramal plates, and an increase of jellified hyphae occurs with aging, particularly near the peridiopellis.

Basidia and cystidia morphology also change with age, being clavate in young specimens and then longly utriform to fusiform.

An interesting question arises concerning its putative relationship of the new taxon with host trees. Both the tree species *Burkea* and *Brachystegia* belong to the subfamily Cesalpinioideae Kunth of the Fabaceae. In the temperate climate, this family seems to contain species that are endomycorrhizal. A few years ago, *Terfezia terfeziodes* (Matt.) Fisher (Pezizales) was repeatedly collected beneath *Robinia pseudoacacia* L. (Faboideae) in Hungary, and its mycorrhiza, endo- and ectendo-type, was described and successfully synthesized (Bratek et al., 1996). No ectomycorrhizal fungi have been recorded beneath Cesalpinioideae species of temperate areas, however the African species of Cesalpinioideae are the main host trees for fungi producing typical ectomycorrhizas (Fassi and Fontana, 1961, 1962; Hogberg , 1982.).

Acknowledgements: We are indebted to Dr. Michael Castellano, Forestry Sciences Lab., Corvallis, for his invaluable suggestions and linguistic improvements to the text.

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MYCOTAXON

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TYPIFICATION OF PLEUROTUS NEBRODENSIS

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ABSTRACT. A lectotype and epitype are here designated for *Pleurotus nebrodensis* (Inzenga) Quélet, based on a comparison between Inzenga's original description and the specimens kept in PC.

KEY WORDS: *Pleurotus nebrodensis*, lectotype, epitype.

Pleurotus nebrodensis (Inzenga) Quélet, a rare taxon of the Sicilian mycoflora, was described by Inzenga (1863) as *Agaricus nebrodensis*.

The protologue includes two figures, one showing the section of a medium-sized specimen, the other illustrating the presence of the characteristic connate basidiomas at the base of the stipe.

After the publication of Inzenga's (1865) first Centuria, that author's judgement of *Agaricus nebrodensis* being a distinct species was confirmed by E. M. Fries (Inzenga 1869). Subsequently many authors relegated it to synonymy or reduced it to infraspecific rank, but a recent survey did not confirm their opinion (Zervakis & Venturella 1998).

Inzenga's herbarium was recently rediscovered at the Istituto Agrario Castelnuovo of Palermo, but it does not include any sample of *P. nebrodensis*.

Fig. 1.

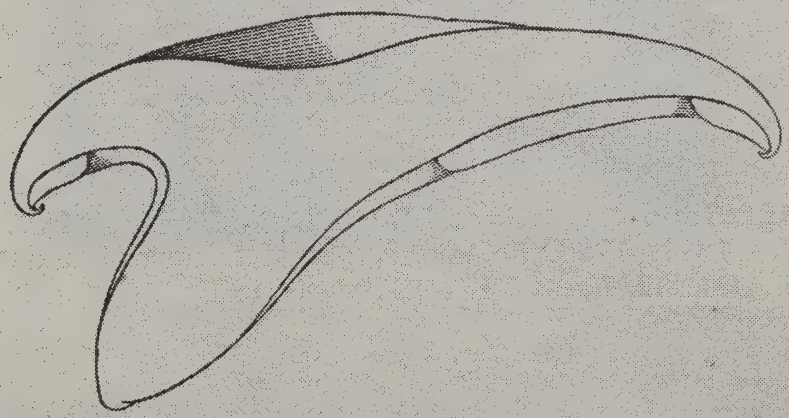

Fig. 1 – Protologue figure No. 1 designated as lectotype.

An herbarium specimen from Inzenga, with a printed label, is kept in the Erbario Crittogamico Italiano, ser. II, in FI(!) and a duplicate of it is deposited in GE. Two other specimens, with handwritten labels by Inzenga are kept in GDOR. None of these are dated.

A specimen kept in UPS(!), is undoubtedly part of the materials that Inzenga sent to E. M. Fries, but, as shown by correspondence between the two authors, subsequent to the original 1863 publication.

Three specimens, whose central one is quite similar to figure no. 1 of Inzenga's protologue, are present in PC(!).

The figure no. 1 of Inzenga's protologue (Fig. 1) is here designated as lectotype, and the PC specimen placed in the centre of the sheet (Fig. 2), as epitype. The lectotype and epitype are both in good agreement with *Pleurotus nebrodensis* as currently understood, and also with Inzenga's original description, being both connected with Inzenga's name.

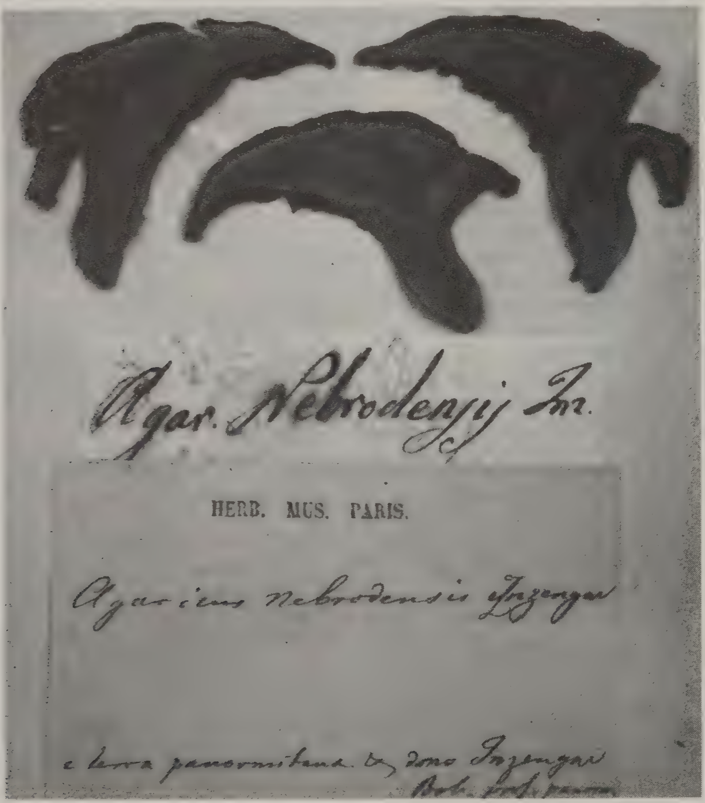
Agar. Nebrodensij Inz.
HERB. MUS. PARIS.
Agaricus nebrodensis Inzenga
e terra panormitana. ex dono Inzengae
Bot. prof. panorm.

Fig. 2 – Specimens of *Pleurotus nebrodensis* kept in PC (in the centre the epitype).

In conclusion, the nomenclature for this species is as follows:

Pleurotus nebrodensis (Inzenga) Quélet, Enchir. fung.: 148 (1886).

(≡) *Agaricus nebrodensis* Inzenga, Giorn. Reale Ist. Incoragg. Agric. Sicil. Palermo, 1: 161-164 (1863). LECTOTYPE, designated here: figure No. 1, illustrating the section of a medium-sized specimen in Inzenga (1863. 162, f. 1); EPITYPE, designated here: "Agaricus nebrodensis Inzenga, e terra panormitana ex dono Inzenga, Bot. prof. panorm." (Herb. Mus. Paris., *Agaricus nebrodensis* PC!).

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GANODERMA AUSTRALE FROM FLORIDA

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Abstract

A specimen of ***Ganoderma*** subgen. ***Elfvingia*** (P. Karst.) Imazeki was collected from hardwood in Miami, Florida in 1991, and pure cultures were established. This single collection was identified as ***G. australe*** (Fr.) Pat. based on morphology of the basidiocarp, cultural studies and mating tests between the dikaryotic cultures from Florida and monokaryotic cultures of *G. australe* TAI-01 from Taiwan. This is the first verification that *G. australe* occurs in the United States.

Key words: ***Ganoderma australe***, morphology, cultural studies, mating tests, Florida.

Ganoderma australe (Fr.) Pat., a member of *Ganoderma* subgenus *Elfvingia*, Ganodermataceae, Aphyllophorales, is mainly distributed in subtropical and tropical belts (Steyaert, 1980; Corner, 1983; and Zhao, 1988). The crust of the pileus of *G. australe* always lacks laccate substances which is easy to distinguish from species of subgenus *Ganoderma* which posses a wrinkled, dull and black pileus with a laccate crust. According to Corner (1983), the subgenera *Elfvingia* and *Ganoderma* belong to the genus *Ganoderma* and have some common characteristics, namely, ovoid basidiospores with a two-layered spore wall separated by interwall pillars.

The type species of the subgenus *Elfvingia* is *G. applanatum* (Pers. ex S.F. Gray) Pat.

Both Ryvarden (1980) and Corner (1983) stated that *G. applanatum* was not known from the tropics and seemed to be confined to the Northern Temperate Zone. Therefore, the species found in subtropical and tropical regions is perhaps *G. australe*. Morphologically, *G. australe* and *G. applanatum* are very similar and difficult to distinguish. However, the two can be separated by the following characteristics: *G. applanatum* has small spores mostly shorter than 8.5 μ m (Ryvarden and Gilberson, 1993) or 9 μ m (Leonard, 1998), usually has a thinner cuticle, less than 0.5 mm (Ryvarden and Gilberson, 1993) or 0.75 mm (Leonard, 1998), and a darker zone in the context above the tube layers which are completely separated by layers of context (Yeh and Chen, 1990; Ryvarden and Gilberson, 1993; Leonard, 1998). In contrast, *G. australe* has larger spores which can exceed 8.5 μ m (Ryvarden and Gilberson, 1993) or 9 μ m (Leonard, 1998), usually has a thicker cuticle up to 0.5 mm (Ryvarden and Gilberson, 1993) or 0.75 mm thick (Leonard, 1998), and dark reddish brown context without a darker zone above the tube layers which are not completely separated by a layer of context (Yeh and Chen, 1990; Ryvarden and Gilberson, 1993; Leonard, 1998).

As the results of field survey of *Ganoderma* in Florida conducted in 1991 by the senior author, some basidiocarps were collected. Among them, one specimen was suspected to be *G. australe*. As there are only four species of *Ganoderma* subgenus *Elfvingia*, namely, *G. annularis, G. applanatum, G. brownii* and *G. lobatum* found in the United States (Gilbertson and Ryvarden, 1986), a comparative examinations by morphology, cultural identification, and di-mon mating with monokaryotic isolates of *G. australe* TAI-01 in Taiwan and dikaryotic isolates in Florida were carried out .

Taiwanese isolates of *G. australe* collected from hardwoods of different localities, were examined based on morphology of basidiocarps, and the mating system of *G. australe* was determined as heterothallic and tetrapolar (Yeh and Chen, 1990). By compatibility and cultural studies, the *G. australe* complex in Taiwan is at least separated into two intersterility groups (Korhonen,1978; Yeh and Chen, 1990). The genetic variation between some isolates of these two groups (including isolates of *G. australe* in Florida.) was investigated by polymerase chain reaction (PCR), restriction fragment length polymorphism (RFLP) analysis of rRNA gene (Yeh et al, 1995), and rDNA sequencing of ITS regions (Chang et al ,1996).

In this paper, we would like to present morphological, cultural, compatibility studies and molecular research data of *G. australe* from Florida.

Materials and Methods

1. Basidiocarp collection

The basidiocarp was found on living stand of *Coccoloba diversifolia* Jacq., near Matheson Hammock Park, Miami, Florida. (collection No. Yeh, FL-01, date: Aug. 5, 1991).

2. Basidiospore morphology studies

Basidiospores were observed by light microscopy, using 3% KOH and 2%phloxine. Spore length and width were determined by ocular micrometer for 20 spores from the fruit body. For SEM observation, a small part of the hymenophore of a specimen was cut to fix in 2.5% glutaraldehyde in 0.1M phosphate buffer at pH 7 for 1h, rinsed in 2 changes of buffer, postfixed for 1h with 2% osmic acid and dehydrated in ethanol. After dehydration the plugs were critical point dried using carbon dioxide, mounted on SEM stubs, sputter coated to a thickness of 20 nm with gold and observation in SEM (Hitachi, S-520).

3. Cultural and temperature studies

Cultures were obtained from context tissue of fruit body and grown on 2% malt extract agar (MEA) media at 24℃. To study cultural characteristics, cultures were grown on 1.25% MEA and incubated at 24℃ in the dark. Optimal growth temperature ranges were determined by growing the isolates for 12 days on 2% MEA at five temperatures ranging from 16 to 32℃.

4. Compatibility studies

The four known monokaryotic mating types of *G. australe* TAI-01 (A1B1, A2B2, A1B2, and A2B1) from Taiwan were crossed with the dikaryotic mycelia from Florida for two weeks. The compatibility tests were examined by taking a small amount of mycelia in monokaryotic cultures to detect if dikaryotic hyphae were formed.

Results

1. Description of the specimen:

Ganoderma australe (Fr.) Pat.

Bull. Soc. Mycol. Fr. 5:67, 1889. –*Polyporus australis* Fr., Elench. Fung. p. 108, 1828. –*Polyporus tornatus* Pers. in Freyc., Voy. aut. Monde, Bot. p. 173, 1827. –*Ganoderma tornatum* (Pers.) Bres., Hedwigia 53:55, 1912.

Basidiocarp (fig. 1) perenial, sessile, dimidiate, somewhat ungulate, up to 17 x 12 x 5 cm; pileus dark brown; hard when dry, zoned with concentric sulcate rings, somewhat cracking when dry, crust 0.9 mm thick; contex dark brown, 4 mm thick; tube layer with lighter color than context, sharply differentiated from the context, without distinct separating context zones between each tube layer, tubes whitish within, up to 2.5 cm thick; pores (fig. 2)5-6 per mm, pore surface whitish gray to light brown.

Basidiospores (fig. 3) ovoid, with a rounded or truncate apex, pale brown in KOH, 5.5-6.8 x 8.8-9.5 μ m. The hyphal system is trimitic with clamped generative hyphae and skeleto-binding hyphae (fig. 4).

2. Cultural and temperature studies

The mycelial mats are white and sphaerical cuticular cells (fig. 5) are abundant in culture. Although there are no Bovista-type binding hyphae observed from this pure culture, its species code is very similar to that of *G. australe* in Taiwan (Yeh and Chen, 1990), namely: 2, 3, 8, 10, 32, 34, 36, 39, 43, 44, 54, 60. (following Nobles, 1965). The optimum growth temperature of dikaryotic cultures of this species is 32℃ (fig. 6), and is similar to the subtropical Group 1 isolates of *G. australe* in Taiwan (Yeh and Chen, 1990), but has a lower average growth rate of 3.5 mm/day at the optimum growth temperature.

3. Basidiospores under SEM observation

Observed by SEM, basidiospores (fig. 7) of this specimen always had logitudinal sulcate depression.

4. Compatibility studies

As shown in Table 1, the dikaryotic mycelia of this species was able to cross with monokaryotic mycelia of *G. australe* TAI-01 in Taiwan. It is confirmed by this mating test that Florida isolate is identical to *G. australe*.

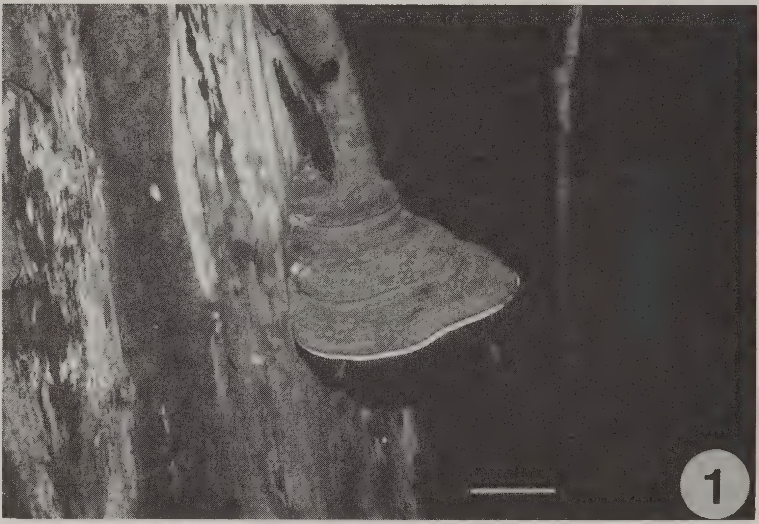


Fig. 1: Growth habit of *G. australe* FL-01.

→

Fig. 2: Pores of *G. australe* FL-01 under SEM.

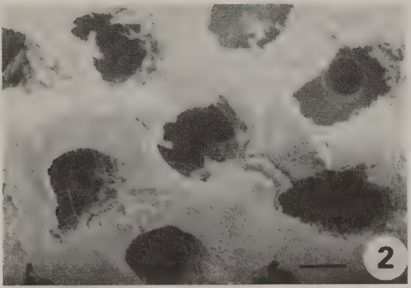
Fig. 3: Basidiospores of *G. australe* FL-01 under bright field microscopy.

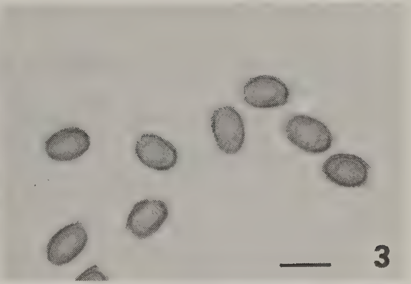
Fig. 4: Skeleto-binding hyphae (sen. Corner, 1983) of *G. australe* FL-01 under SEM observation.

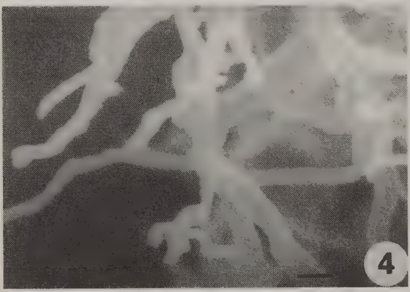
Fig. 5: Pure cultures of *G. australe* FL-01 appear cuticular cells.

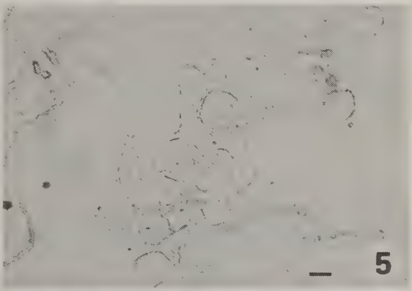
Fig. 6: Mycelial growth of *G. australe* FL-01 on MEA after 12 days at various temperature.

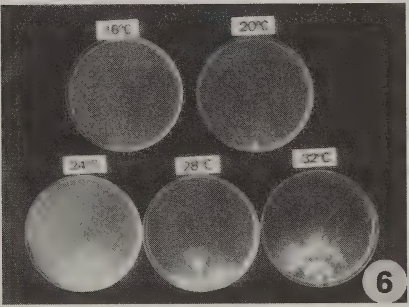
Fig. 7: Basidiospores of *G. australe* FL-01 under SEM observation.
Scale bars:1 = 5cm , 2 = 66 μm , 3 = 10 μm, 4 = 2.5 μm , 5 =10 μm , 7 = 1.3 μm


2


3


4


5


16°C
20°C
24°C
28°C
32°C
6

7

Table 1. Mating tests between dikaryotic mycelia of *G. australe* in Florida and monokaryotic mycelia of *G. australe* TAI-01 in Taiwan

Dikaryotic mycelia	Monokaryotic mycelia (Taiwan)			
	TAI-01 M1 A1B1	TAI-01 M7 A1B2	TAI-01 M11 A2B1	TAI-01 M6 A2B2
G. australe (Florida)	+	+	+	+

+: Dikaryotic mycelia with clamp connections

Discussion

The comparative investigations of *G. australe* from Florida and Taiwan revealed that both collections were identical despite the cultures of Florida isolate lacked the Bovista-type binding hyphae and rather slow growth rate (3.5 mm/day) at its optimum growth temperature, 32℃.

The spore size is one of the most important criteria for taxonomic work on fungi. The basidiospores of *G. australe* given by Ryvarden and Johansen (1980) were 6-13 x 4.5-9 μm, by Petersen (1987; *G. adspersum*, a synonym of *G. australe*) were 8.5-12 x 6-8 μm, by Ryvarden and Gilberson (1993) were 8.5-10(-12) x 5-7.5 μm, and by Leonard (1998) were (7-) 8.0-13.0 x 5.5-8.5 μm. The spore measurements of *G. australe* from Florida were 8.8-9.5 x 5.5-6.8 μm and these fit the species concept of *G. australe* (Fr.) Pat.

Based on published molecular research data by Yeh et al.(1995) and Chang et al.(1996), the polymerase chain reaction (PCR), restriction fragment length polymorphisms (RFLPs) and DNA sequencing molecular approaches were applied to assess genetic problems. By using conserved primers complementary to rRNA genes of *Saccharomyces cerevisiae*, a 2.16-kb A fragment containing 17S rRNA gene and a 1.85-kb B fragment containing 5' half of 25S rRNA gene were efficiently amplified from ribosomal DNA (rDNA) repeats of these fungi. Electrophoresis of *Hha*I, *Ava*II or *Hin*fI digested PCR products produced restriction phenotypes (fingerprints). The two intersterility groups of *G. australe* in Taiwan can be differentiated by *Ava*II and *Hin*fI restriction phenotypes. In addition, minor sequence heterogeneity of rDNA repeats within *G. australe* FL-01 isolate was observed. Detail mapping of restriction sites within rDNA locus by partial digestion and Southern hybridization reveals conserved and variable restriction sites for each species or group. The DNA fragments containing internal transcribed spacer (ITS) regions were also amplified. The PCR-amplified products were subcloned into pGEM-T and sequenced. Phylogenetic structures were

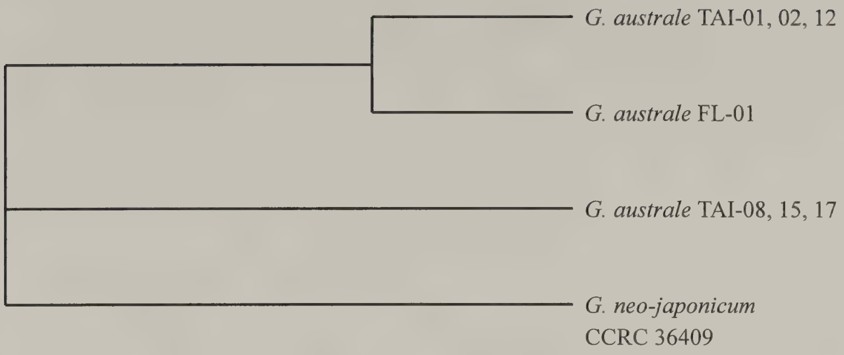

G. australe TAI-01, 02, 12
G. australe FL-01
G. australe TAI-08, 15, 17
G. neo-japonicum CCRC 36409

Fig. 8: Phylogenetic relationships of isolates inferred from restriction sites by PAUP program. Tree length = 9; Consistency index = 1.000; Retention index = 1.000. (cited from Yeh et al, 1995, fig. 4)

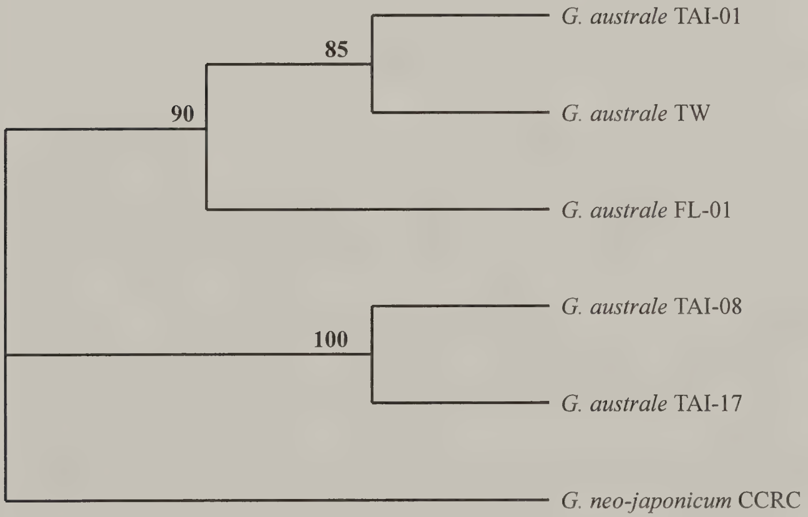

G. australe TAI-01
85
G. australe TW
90
G. australe FL-01
G. australe TAI-08
100
G. australe TAI-17
G. neo-japonicum CCRC

Fig. 9: Phylogenetic relationships of isolates inferred from sequences of ITS regions. Only cladistically informative sites as defined in the PAUP program were used in the phylogenetic analysis. Phylogram was generated from 200 bootstrap replications. The confidence levels of bootstrap replications (numbers in percentage) above the branches are averaged from ITS1, ITS2 and combined values of ITS regions. Tree length =91; Consistency index = 0.89; Retention index = 0.83. (cited from Chang et al, 1996, fig. 5)

constructed from analyses of restriction sites and ITS regions by PAUP program. The data suggest that Florida isolate FL-01 is very closely related to the Group 1 of *G. australe* in Taiwan. According to genetic distance and phylogeny reconstruction, isolate FL-01 falls in the Group 1 but not the Group 2 of *G. australe* in Taiwan (figs. 8 and 9). This means both isolates belong to the same " intersterility group" of *G. australe*.

This is the first report of distribution of *G. australe* in the United States of America.

Acknowledgments

We would like to thank Dr. L. Ryvarden for confirming the identification of the specimen and for kindly reviewing this paper. We also thank Mr. S. H. Chen for accompanying the field collecting and Mr. C. H. Chen for arranging the photographs.

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WOOD-INHABITING APHYLLOPHORACEOUS FUNGI ON JUNIPERUS SPP. IN ITALY

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ABSTRACT

Aphyllophoraceous fungi growing on *Juniperus* spp. in Italy have been investigated. 295 collections were recorded representing 105 species from 59 genera. *Amyloathelia amylacea, Antrodia pulvinascens, Chaetoderma luna, Hyphoderma cryptocallimon, Hyphodontiella multiseptata, Lenzitella malenconii, Oligoporus mappus, Phellinus pseudopunctatus, Thanatephorus sterigmaticus, Trametes junipericola*, *Tremella polyporina* and *Ypsilonidium sterigmaticum* are reported as new from Italy. *Hyphoderma etruriae*, *Echinodontium ryvardenii, Neolentiporus squamosellus* and *Phellinus juniperinus* have previously been described as new species from *Juniperus*.

Key words: Aphyllophorales, wood-inhabiting fungi, *Juniperus*.

INTRODUCTION

Juniperus species rarely dominate forest communities and thus, only scattered oberservations on its fungi can be found in the literature. An outstanding exception is Gilbertson et al. (1975-1978-1985-1987) who over years collected intensively on different *Juniperus* spp. in Arizona and the Gulf Coast region (Texas, Louisiana and Eastern Missisippi). They reported 83 species, including some agarics from *Juniperus virginiana*, *J. silicicola*, *J. ashei* and *J. phoenicea*.

During the last twenty years the author has collected quite intensively on *Juniperus* spp. when the occasion arose and 295 of these collections are reported here, mainly from Corticiaceae s.l. and Polyporaceae.

Some species, such as *Neolentiporus squamosellus* (Bernicchia & Ryvarden) Bernicchia & Ryvarden, *Phellinus juniperinus* Bernicchia & Curreli and *Echinodontium ryvardenii* Bernicchia & Piga have already been described as new species (Bernicchia, 1990; Bernicchia & Ryvarden, 1996-98; Bernicchia & Piga, 1998). In this paper many rare and new species to the Italian mycoflora are reported, most of them restricted to Sardinia Island where it is still possible to find small areas with some living pluricentenarian juniper trees.

The collecting was restricted to the following four junipers species: *Juniperus communis* L., is common and widely distributed in Italy; *J. nana* Willd. forms small bushes, generally present only in heathy areas over 1500 m s/l in the Northern and Central part of Italy; *J. oxycedrus* subs. *oxycedrus* L. has a wide distribution, with only few exceptions, and very often in the maquis and «gariga» of Mediterranean area; *J. oxycedrus* subs. *macrocarpa* (S. et S.) Ball is typical of *Lauretum*, has a distributional range on sandy soils along the Adriatic, Jonic and Tirrenic Coast in the Central and Southern Italy. *J. phoenicea* L. grows mainly in the maquis of coastal areas from the sea level to 600 m of altitude. Along the Tirrenic Coast and the low Adriatic sea it grows very often togheter with *J. oxycedrus* subs.

macrocarpa. No collection has been done on *Juniperus hemisphaerica* Presl, circumscribed to windy spurs and peaks of Southern Italy mostly in Sicily and Calabria, and *J. sabina* L., typical of some continental glens and sunny slopes and cliffs in Northern and Central Italy.

Figure 1 indicates the most important collecting areas:

1 Basovizza (Trieste) m 400
2 Borgo Grotta del Gigante (Trieste) m 600
3 Torrente Limana (Belluno) m 400
4 Pineta di Cervia (Ravenna)
5 Bosco della Mesola, Loc. Le Cave (Ferrara)
6 Valle dell'Idice (Bologna) m 400
7 Parco La Martina (Bologna) m 650
8 Monte Piella (Bologna) m 900-1000
9 Parco Corno alle Scale (Bologna) m 800-1500
10 Riserva di Sasso Fratino (Forlì) m 700-1500
11 Torrente Lubiana, Tarsogno (Parma) m 800
12 Foresta di Bibbona (Livorno)
13 Foresta di Caselli (Livorno) m 150
14 Riserva di Burano (Livorno)
15 Pineta di Alimini (Lecce)
16 Capo Comino (Nuoro)
17 Valle di Lanaittu (Nuoro) m 180
18 Cala Gonone (Nuoro)
19 Campu'e su mudrecu, Supramonte di Orgosolo (Nuoro) m 950
20 Is scalas arenas, Supramonte di Orgosolo (Nuoro) m 800-900
21 Arzana, Gidinis (Nuoro) m 920
22 Arzana, Lione (Nuoro) m 800
23 Piraonni (Nuoro) m 850
24 Is Arenas (Oristano)
25 Gentilis (Cagliari) m 400
26 Portixeddu (Cagliari)

Of the reported species, only 17 (almost 15%) are known to cause a brown rot while the other ones are known or suspected to be white rot fungi.

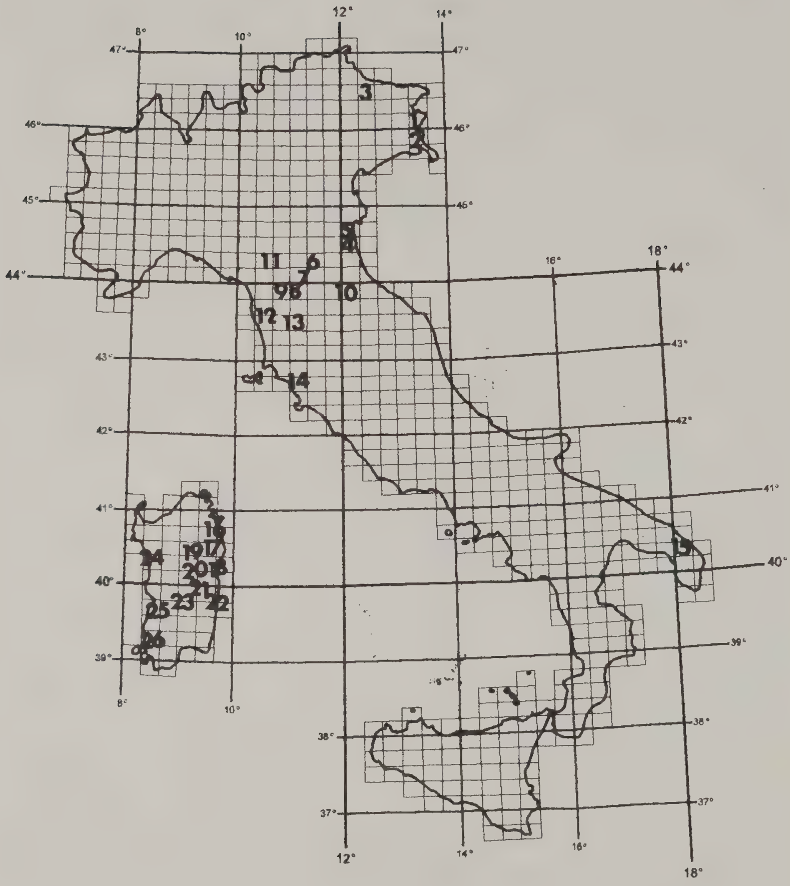
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Figure 1 : map of Italy with the most important collecting areas.

All the collections are deposited in Herbarium H. U. B. O. The nomenclature follows that of Eriksson et al. (1975-1988), Ryvarden & Gilbertson (1993-1994) and Parmasto (1997). Some species are illustrated and expounded. The number of collections is given in brackets ahead the location distributional reference.

Amphinema byssoides (Pers. : Fr.) J. Erikss.

(1) 1, (1) 4, (1) 9, all on *J. communis*. It is a common and widespread species both on coniferous and broadleaved wood.

Amyloathelia amylacea (Bourdot & Galzin) Hjortstam & Ryvarden

(5) 19, all on *J. oxycedrus* subs. *oxycedrus*, new to Italy. It is a rare species in Europe and it was growing in a very arid, sunny and stony area. Det. N. Hallenberg (Figure 2).

Amylostereum laevigatum (Fr.) Boidin

(1) 2, (2) 4, (2) 5, (1) 7, (1) 8, (1) 10, (1) 17, (1) 22, all on *J. communis*; 17, 22, (1) on *J. oxycedrus* subs. *oxycedrus*; 14, 26 (1) on *J. oxycedrus* subs. *macrocarpa*. It is very frequently collected on Juniper wood.

Antrodia pulvinascens (Pilát) Niemelä

(7) 19, on *J. oxycedrus* subs. *oxycedrus*. It is the first Italian record. In Scandinavia known only on *Populus tremula* while in Central Europe and Spain also on *Salix* sp. (Ryvarden & Gilbertson, 1993). It was growing on burnt wood of Juniper left over after a fire in 1931 which destroyed a splendid Juniper forest in the locality. It is difficult to find fertile specimens of this species, mostly only few basidiospores were seen. On the same tree I collected *Piloporia sajanensis* and *Neolentiporus squamosellus*.

Antrodia serialis (Fr.) Donk

(1) 20, on *J. oxycedrus subs. oxycedrus*.

Asterostroma cervicolor (Berk. & M.A. Curtis) Massee s.l.

(1) 9, on *J. nana*. It is a rare species in Italy. In Sardinia more frequently it is growing on *Santolina* and *Helychrysum*.

Athelia arachnoidea (Berk.) Jülich

(1) 20, on *J. oxycedrus* subs. *oxycedrus*, (1) 14, on *J. oxycedrus* subs. *macrocarpa*.

Athelia binucleospora J. Erikss. & Ryvarden

(1) 20, on *J. oxycedrus* subs. *oxycedrus*.

Athelia pyriformis (M.P. Christ.) Jülich

(1) 2, on *J. communis*. Its is an uncommon species.

Basidioradulum tuberculatum (Fr. : Fr.) Nobles
(1) 5, on *J. communis*. It is a rare species in Italy.

Brevicellicium exile (Jacks.) K.H. Larss. & Hjortstam
(1) 19, on *J. oxycedrus* subs. *oxycedrus*. It is an uncommon species in Italy with only few records. Det. N. Hallenberg.

Byssocorticium atrovirens (Fr.) Bondartsev & Singer
(2) 5, (1) 6, (1) 7, all on *J. communis*. It is very often collected on broadleaves wood.

Byssomerulius hirtellus (Burt) Parmasto
(1) 14, on *J. phoenicea*; (3) 21, on *J. oxycedrus* subs. *oxycedrus*. It is more frequently found on broadleaved wood.

Ceriporiopsis mucida (Pers. : Fr.) Gilb. & Ryvarden
(1) 20, on *J. oxycedrus* subs. *oxycedrus*.

Chaetoderma luna (Romell) Parmasto
(3) 19, on *J. oxycedrus* subs. *oxycedrus*. It is new to Italy and a rare species with splendid cystidia and lunate basidiospores. (Figure 3).

Coniophora arida (Fr.) P. Karst.
(1) 2, (1) 7, all on *J. communis*; (2) 14, on *J. oxycedrus* subs. *macrocarpa*; (1) 17, on *J. phoenicea*.

Coniophora puteana (Schumach. : Fr.) P. Karst.
(1) 14, on *J. phoenicea*.

Coriolopsis gallica (Fr.) Ryvarden
(1) 5, on *J. communis;* (1) 19, on *J.oxycedrus* subs. *oxycedrus*.

Cristinia helvetica (Pers.) Parmasto
(1) 8, on *J communis*.

Cyphella sp.
(1) 9, on *J. nana*.

Dacryobolus sudans (Alb. & Schwein. : Fr.) Fr.
(1) 14, on *J. phoenicea*; (4) 5, on *J. communis*; (1) 19, on *J. oxycedrus* subs. *oxycedrus*.

Dendrothele griseo-cana (Bres.) Bourdot & Galzin
(1) 2, on *J. communis*; (2) 14, on *J. phoenicea*.

Dendrothele nivosa (Höhn. & Litsch.) P.A. Lemke
(10) 19, (2) 20, (1) 21, (2) 26, on *J. oxycedrus* subs. *oxycedrus*; (3) 17, on *J. phoenicea*. In the collecting

localities is not rare to note the white and chalky resupinate basidioma.

Echinodontium ryvardenii Bernicchia & Piga

(1) 16, (3) 17, on *J. phoenicea*; (2) 26, on *J. oxycedrus* subs. *macrocarpa*. It is a splendid polypore. It is the first European collection of *Echinodontium* while all previous ones are North American or Asiatic. The Sardinian localities must be looked upon as a relict of a previously larger distribution. For a description and discussion of its taxonomic position, see Bernicchia & Piga 1998 (Figure 4).

Gloeocystidiellum luridum (Bres.) Boidin

(1) 7, on *J. communis*.

Gloeophyllum abietinum (Bull. : Fr.) P. Karst.

(1) 20, on *J. oxycedrus* subs. *oxycedrus*.

Gloeophyllum sepiarium (Wulf. : Fr.) P. Karst.

(2) 17, on *J. phoenicea*; (2) 20, on *J. oxycedrus* subs. *oxycedrus*.

Hymenochaete cinnamomea (Pers.) Bres.

(2) 22, on J. *oxycedrus* subs. *oxycedrus*.

Hyphoderma cryptocallimon B. De Vries

(1) 19, (1) 20, on *J. oxycedrus* subs. *oxycedrus*. It is a rare species collected in only two localities in Italy (Figure 5).

Hyphoderma etruriae Bernicchia

(6) 14, (1) 15, (1) 16, on *J. phoenicea*.

Hyphoderma orphanellum (Bourdot & Galzin) Donk

(1) 20, on *J. oxycedrus* subs. *oxycedrus*. It is a rare species in Italy.

Hyphoderma pallidum (Bres.) Donk

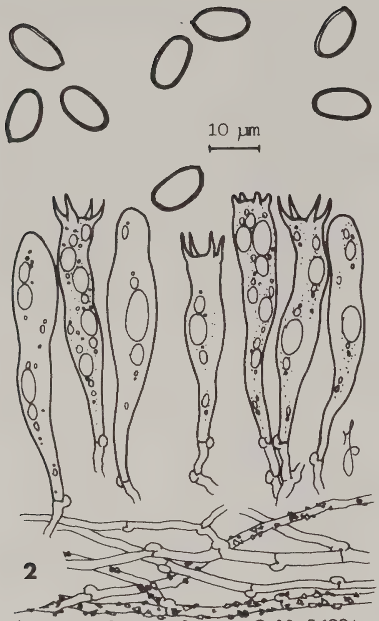
(1) 5, (1) 11, on *J. communis*; (1) 20, on *J. oxycedrus* subs. *oxycedrus*; (1) 14, on *J. oxycedrus* subs. *macrocarpa*. It is a common species on coniferous wood.

Hyphoderma praetermissum (P. Karst.) J. Erikss. & A. Strid

(2) 1, (3) 5, on *J. communis*; (2) 20, on *J oxycedrus subs. oxycedrus*.

Hyphoderma puberum (Fr.) Wallr.

(1) 15, on *J. oxycedrus* subs. *macrocarpa*.



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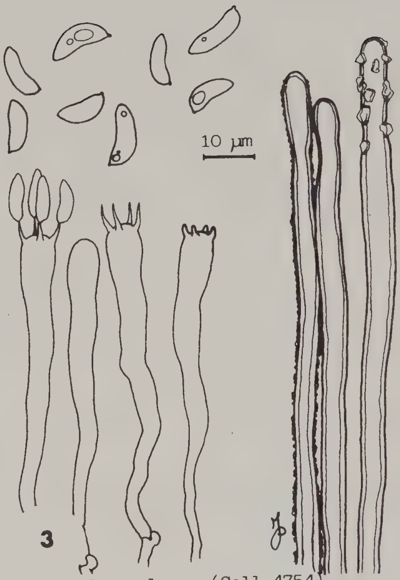
Amyloathelia amylacea (Coll.5402)



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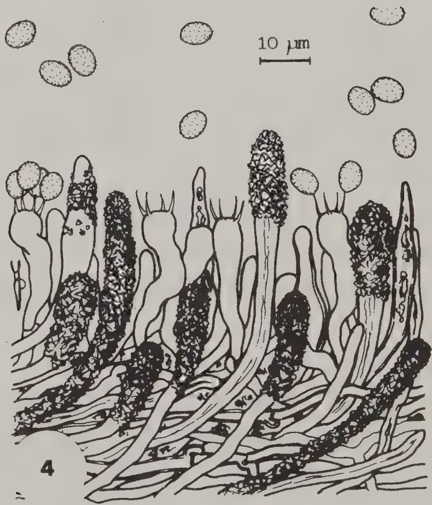
Chaetoderma luna (Coll.4754)



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Echinodontium ryvardenii (coll. 6907)

Figure 2 : hymenial elements of *Amyloathelia amylacea*
Figure 3 : hymenial elements of *Chaetoderma luna*
Figure 4 : hymenial elements of *Echinodontium ryvardenii*

Hyphoderma setigerum (Fr.) Donk
(1) 14, on *J. phoenicea*; (2) 15, on *J. oxycedrus* subs. *macrocarpa*.

Hyphodermella corrugata (Fr.) J. Erikss. & Ryvarden
(1) 12, on *J. communis*.

Hyphodontia alutaria (Burt) J. Erikss.
(2) 5, on *J. communis*.

Hyphodontia arguta (Fr.) J. Erikss.
(1) 2, (1) 3, (1) 4, (1) 5, all on *J. communis*.

Hyphodontia aspera (Fr.) J. Erikss.
(1) 19, on *J. oxycedrus* subs. *oxycedrus*.

Hyphodontia breviseta (P. Karst.) J. Erikss.
(1) 21, on *J. oxycedrus* subs. *oxycedrus*.

Hyphodontia crustosa (Pers. : Fr.) J. Erikss.
(1) 1, (1) 4, (1) 5, (1) 7, all on *J. communis*; (1) 14, on *J. phoenicea*; (2) 20, on *J. oxycedrus* subs. *oxycedrus*.

Hyphodontia gossypina (Parmasto) Hjortstam
(1) 14, on *J. oxycedrus subs. macrocarpa* and (1) 14, on *J. phoenicea*.

Hyphodontia juniperi (Bourdot & Galzin) J. Erikss. & Hjortstam
(1) 2, (2) 5, (1) 10, (1) 11, (2) 13, on *J. communis*; (2) 19, on *J. oxycedrus* subs. *oxycedrus*; (2) 14, (1) 16, on *J. phoenicea*; (1) 15, on *J. oxycedrus* subs. *macrocarpa*. It is very frequently collected on Juniper wood.

Hyphodontia pruni (Lasch) Svrcek
(1) 14, on *J. oxycedrus* subs. *macrocarpa*.

Hyphodontia sambuci (Pers.) J. Erikss.
(1) 19, on *J. oxycedrus* subs. *oxycedrus*.

Hyphodontiella multiseptata A. Strid
(2) 9, on *J. nana*. It is the first record in Italy.

Hypochniciellum ovoideum (Jülich) Hjortstam & Ryvarden
(1) 7, on *J. communis*; (1) 21, on *J oxycedrus* subs. *oxycedrus*.

Inonotus cuticularis (Bull. : Fr.) P. Karst.
(1) 20, on *J. oxycedrus* subs. *oxycedrus*.

Kavinia himantia (Schwein.) J. Erikss.

(1) 9, on *J. nana*; (1) 17, on *J. phoenicea*, (4) 20, on *J. oxycedrus* subs. *oxycedrus*. It is an uncommon species with a scanty distribution.

Lenzitella malençonii Ryvarden

(2) 23, on *J. oxycedrus* subs. *oxycedrus*. It is new to Italy, collected on a multicentenarian Juniper. In the area only few old trees are left, growing on high pastures where sheep can injure large part of the boles. The basidioma were growing on small clefts of the large branches (Figure 6).

Leucogyrophana romellii Ginns

(1) 7, on *J. communis*.

Lindtneria sp.

(1) 7, on *J. communis*. It is a new species not yet described.

Litschauerella clematitis (Bourdot & Galzin) J. Erikss. & Ryvarden

(1) 9, on *J. nana*; (2) 14, on *J. phoenicea*.

Neolentiporus squamosellus (Bernicchia & Ryvarden) Bernicchia & Ryvarden

(10) 19, on *J. oxycedrus* subs. *oxycedrus*. It is known only from one collecting area in Italy. It has recently been collected in the South France by Rivoire and Pieri (Figure 7).

Oligoporus caesius (Schrad. : Fr.) Gilb. & Ryvarden

(1) 2, (1) 5, on *J. communis*.

Oligoporus hibernicus (Berk. & Broome) Gilb. & Ryvarden

(1) 14, on *J. oxycedrus* subs. *macrocarpa*; (1) 20, on *J. oxycedrus* subs. *oxycedrus*.

Oligoporus inocybe (A. David & Malençon) Ryvarden & Gilb.

(3) 14, on *J. oxycedrus* subs. *macrocarpa*. It is a rare species with only few collections.

Oligoporus leucomallellus (Murrill) Gilb. & Ryvarden

(2) 5, on *J. communis*.

Oligoporus mappus (Overh. & Lowe) Gilb. & Ryvarden

(1) 20, on *J. oxycedrus* subs. *oxycedrus*. It is a rare species in Europe and this is the only collection in Italy.

Peniophora boidinii D.A. Reid

(1) 14, on *J. phoenicea*, det. J. Boidin. It is a rare species, typical of Mediterranean area.

Peniophora junipericola J. Erikss.

(1) 2, (1) 5, (1) 13, on *J. communis*; (4) 20, on *J. oxycedrus* subs. *oxycedrus*.

Peniophora lycii (Pers.) Höhn. & Litsch.

(1) 4, (1) 6, (1) 7, on *J. communis*; (1) 19, (2) 20, on *J. oxycedrus* subs. *oxycedrus*. It is a common species all over the places.

Peniophora meridionalis Boidin

(1) 20, on *J. oxycedrus* subs. *oxycedrus* It is common on broadleaved wood in the Mediterranean area.

Peniophora versicolor (Bres.) Sacc. & Sydow

(1) 14, on *J. oxycedrus* subs. *macrocarpa* and (1) 14, on *J. phoenicea*. It is a typical Mediterranean species.

Perenniporia rosmarini A. David & Malençon

(3) 17, (1) 20, on *J. oxycedrus* subs. *oxycedrus*; (2) 18, on *J. phoenicea*. In some restricted areas of Sardinia it is the most common species growing on *Rosmarinus officinalis.*

Phanerochaete galactites (Bourdot & Galzin) J. Erikss.

(1) 14, on *J. phoenicea*.

Phanerochaete laevis (Fr.) J. Erikss. & Ryvarden

(1) 22, on *J. oxycedrus* subs. *oxycedrus*.

Phanerochaete martelliana (Bres.) J. Erikss. & Ryvarden

(1) 19, (1) 20, on *J. oxycedrus* subs. *oxycedrus*. The cystidia in Sardinian collections are frequently apically branched.

Phanerochaete tuberculata (P. Karst.) Parmasto

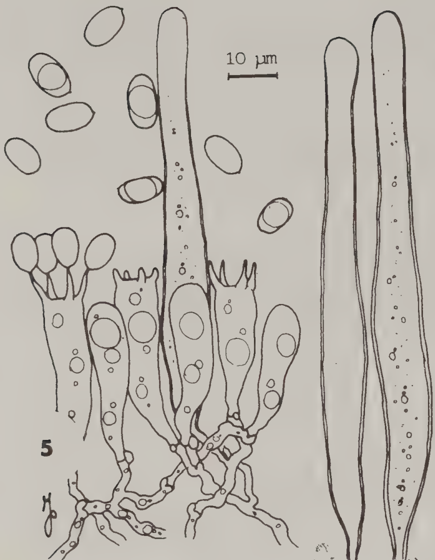
(1) 21, on *J. oxycedrus* subs. *macrocarpa*.

Phellinus ferruginosus (Schard. : Fr.) Bourdot & Galzin

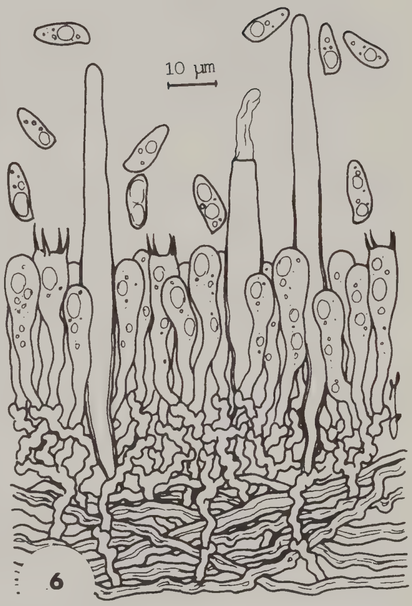
(1) 2, (1) 5, on *J. communis*.

Phellinus juniperinus Bernicchia & Curreli

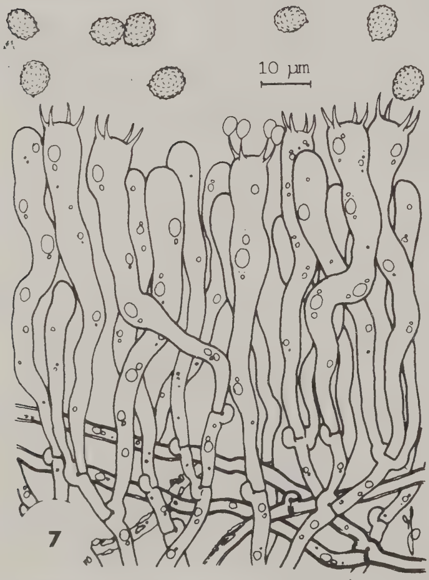
(1) 18, (1) 20, (1) 25, on *J. oxycedrus* subs. *oxycedrus*; (1) 17, on *J. phoenicea*. All the Italian records have been collected in Sardinia. Rivoire and Pieri have recently collected it in the South France.



Hyphoderma cryptocallimon (Coll.4814)



Neolentiporus squamosellus (Coll. 6650)



Lenzitella malenconii (Coll.6909)

Figure 5 : hymenial elements of *Hyphoderma cryptocallimon*
Figure 6 : hymenial elements of *Lenzitella malenconii*
Figure 7 : hymenial elements of *Neolentiporus squamosellus*

Phellinus pseudopunctatus A. David, Dequatre & Fiasson
(1) 14, on *J. phoenicea*. It is the first Italian collection.

Phellinus punctatus (P. Karst.) Pilát
(1) 14, *Juniperus* sp.

Phellinus sp.
(2) 20, on *J. oxycedrus* subs. *oxycedrus*.

Phellinus torulosus (Pers.) Bourdot & Galzin
(2) 14, on *J. phoenicea*.

Phlebia subcretacea (Litsch.) M.P. Christ.
(1) 2, on *J. communis*. It is a rare species in Italy.

Phlebiella vaga (Fr.) P. Karst.
(1) 2, (1) 8, on *J. communis*; (1) 9, on *J. nana*.

Piloporia sajanensis (Parmasto) Niemelä
(1) 19, on *J. oxycedrus* subs. *oxycedrus*. It has been found only once in Italy (Bernicchia & Ryvarden, 1997). It is a very rare species and known only from Central Asia and Fennoscandia (Ryvarden, 1986). Its presence in Sardinia must be looked upon as a relict from the last glaciation and could have been left on one of its available hosts in this remote area. Det. L. Ryvarden.

Pseudomerulius aureus (Fr.) Jülich
(1) 11, on *J. communis*.

Radulomyces confluens (Fr. : Fr.) M.P. Christ.
(1) 5, on *J. communis*; (1) 14, on *J. phoenicea*; (1) 21, on *J. oxycedrus* subs. *oxycedrus*.

Radulomyces rickii (Bres.) M.P. Christ.
(1) 14, on *Juniperus* sp.

Sebacina deminuta Bourdot
(1) 20, on *J. oxycedrus* subs. *oxycedrus*.

Sistotrema muscicola (Pers.) S. Lundell
(1) 5, on *J. communis*. It is a rare species in Italy.

Sistotremastrum suecicum Litsch. & J. Erikss.
(1) 8, on *J. communis*.

Steccherinum ochraceum (Pers. : Fr.) Gray
(1) 19, (1) 20, on *J. oxycedrus* subs. *oxycedrus*.

Thanatephorus sterigmaticus (Bourdot) P.H.B. Talbot
(1) 17, on *J. phoenicea*. Det. N. Hallenberg

Tomentella ellisii Jülich & Stalpers
(1) 4, on *J. communis.*
Tomentella ferruginea (Pers. : Fr.) Pat.
(1) 2, on *J. communis.*
Tomentella subclavigera Litsch.
(1) 2, on *J. communis.*
Tomentella sublilacina (Ellis & Holw.) Wakef.
(1) 2, on *J. communis.*
Tomentella violaceofusca (Sacc.) M.J. Larsen
(1) 2, on *J. communis.*
Tomentellopsis zygodesmoides (Ellis) Hjortstam
(1) 2, on *J. communis.*
Trametes junipericola Manjon, G. Moreno & Ryvarden
(1) 17, on *J. phoenicea.* It is a very rare species in Europe and the first record in Italy.
Trechispora cohaerens (Schwein.) Jülich & Stalpers
(1) 5, on *J. communis*; (1) 20, on *J oxycedrus* subs. *oxycedrus*; (1) 15, on *J. oxycedrus* subs. *macrocarpa.*
Trechispora confinis (Bourdot & Galzin) Liberta
(1) 17, on *J. phoenicea.*
Trechispora farinacea (Pers. : Fr.) Liberta
(2) 5, on *J. communis*; (1) 14, on *J. phoenicea.*
Tremella polyporina D.A. Reid
(1) 5, growing on *Oligoporus* sp. on *J. communis.* It is the first collection in Italy. Det. J. Ginns.
Tubulicrinis medius (Bourdot & Galzin) Oberw.
(2) 14, on *J. oxycedrus* subs. *macrocarpa* and (2) 14, on *J. phoenicea*; (1) 20, on *J. oxycedrus* subs. *oxycedrus.*
Tubulicrinis sororius (Bourdot & Galzin) Oberw.
(5) 19, (1) 20, (1) 21, on *J. oxycedrus* subs. *oxycedrus.*
Tulasnella violacea (Johan-Olsen) Juel
(1) 7, on *J. communis.*
Uthatobasidium fusisporum (J. Schröt.) Donk
(1) 9, on *J. nana.*
Vararia maremmana Bernicchia
(5) 14, (1) 15, (2) 17, on *J. phoenicea*; (1) 20, (2) 21, on *J.*

oxycedrus subs. *oxycedrus*.

Vararia ochroleuca (Bourdot & Galzin) Donk

(2) 2, (2) 5, (4) 7, all on *J. communis*. The basidiospores are always smaller than usual.

Ypsilonidium sterigmaticum (Bourdot) Donk

(1) 20, on *J. oxycedrus* subs. *oxycedrus*. It is a very rare species.

CONCLUSIONS

Most of the reported species are common and widespread whereas some of the rarer are more or less restricted to Sardinia, often in dry, stony and arid areas. They occur only after the start of the rainy season, usually from the end of October and until the snow arrives. One of these interesting localities is Campu'e su mudrecu, Supramonte of Orgosolo (Nuoro) that is at an altitude of from 950 to 1000 m with some remaining *Juniperus oxycedrus* and scattered *Quercus ilex*, windswept by mistral. Many among the most interesting Italian collections were collected here besides rare species such as *Piloporia sajanensis* and *Neolentiporus squamosellus*. This area was covered in the past with the widest juniper forest in Europe. Some fragments of petrified wood were collected in that area as well.

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ZYGOPLEURAGE ZYGOSPORA,
A NEW RECORD FROM VENEZUELA

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ABSTRACT

During a continuing study of coprophilous fungi in Venezuela, a sordariaceous pyrenomycete with unusual ascospores was isolated from calf dung. The ascospores were composed of two, dark brown, smooth, ellipsoidal end cells that were connected by a long, hyaline, hyphal intercalary cell. These features place the fungus in *Zygopleurage*, a genus characterized by nonstromatic, obpyriform, ostiolate perithecia, with indistinct paraphyses and clavate, unitunicate, long-stipitate asci. The species was identified as *Zygopleurage zygospora*, which represents a new record for Venezuela.

Key Words: Ascomycota, Lasiosphaeriaceae, Sordariales, Venezuela, *Zygopleurage*.

INTRODUCTION

Members of the Sordariaceae, as reported in previous studies of this family of pyrenomycetes (Lundqvist, 1972, Moreau, 1953), are considered to be saprobic and they are found predominately on dung. During a study of coprophilous fungi in Venezuela, conducted in

July, 1995, numerous perithecia of a sordariaceous fungus were found growing on calf dung. The unusual ascospores of this fungus consist of two ellipsoidal, brown end cells, each with a germ pore, and connected by a long, slender, hyaline intercalary cell. These characteristics place it in *Zygopleurage* (Dennis, 1981; Lundqvist, 1972), a genus that has one of the most unusual ascospores of all known coprophilous Pyrenomycetes, and which are equalled by few other Ascomycota. This represents the first report of a species of *Zygopleurage* from Venezuela (Dennis, 1970). The genus *Zygopleurage* comprises three species: *Z. faigumensis* N. Lundq., *Z. multicaudata* Mirza, and *Z. zygospora* (Speg.) Boedijn (Lundqvist, 1969). After comparison of the Venezuelan material with published species descriptions (Cain, 1934; Griffiths, 1901; Lundqvist, 1969), it was identified as *Z. zygospora*; a description of this material is given below.

MATERIALS AND METHODS

Procedures for collecting and inducing ascomal formation in *Z. zygospora* were similar to those described by Bell (1989). Dry calf dung was placed in a moist chamber and after seven days yielded numerous perithecia of *Z. zygospora*. The fungus was then mounted in water and studied with a light microscope. Measurements and drawings of the various structures were made, and photographs also were taken on a Leitz microscope equipped with an automatic camera. Attempts to obtain the fungus in pure culture were unsuccessful. The Venezuelan material has been accessioned in the herbarium of the Department of Plant Health, Faculty of Agronomy, University of Zulia, Maracaibo, Venezuela (HERZU).

OBSERVATIONS

Zygopleurage zygospora (Speg.) Boedijn
≡*Sordaria zygospora* Speg.
≡*Philocopra zygospora* (Speg.) Sacc.
≡*Podospora zygospora* (Speg.) Niessl
≡*Pleurage zygospora* (Speg.) Kuntze

Ascoma an ostiolate perithecium, nonstromatic, scattered, usually with base partially immersed in substrate, clothed with brown, septate, hyphal hairs. Perithecia obpyriform, dark black under reflected light, 820-1,100 μm high X 495-830 μm wide, with the neck 280-520 X 132-240 μm (Fig. 1A). Peridium membranaceous, semitransparent, brown to light black under transmitted light. The young centrum contains filiform paraphyses whose cells often become vesiculose before deliquescing early. Asci unitunicate, with a small, nonamyloid apical ring, cylindrical to subclavate, tapering at the base, 8-spored, 240-280 X 35-60 μm. Ascospores fusiform, hyaline and one-celled when delimited, then elongating rapidly to form a tubular, cylindrical cell that begins to swell at each end. The enlarging terminal cells are delimited by septa, forming a 3-celled spore. As the ascospore matures the end cells become dark

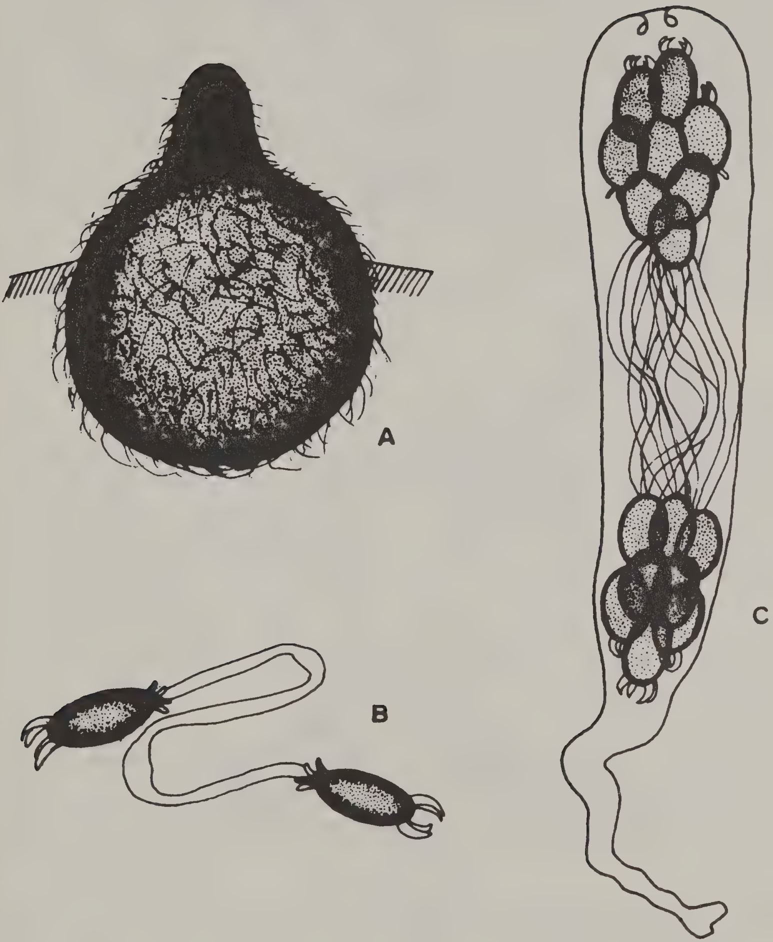

Figure 1. Morphology of *Zygopleurage zygospora*. **A.** Exterior of perithecium. **B.** Mature ascospore. **C.** Mature ascus with ascospores.

brown, 34-38 X 17-23 µm, smooth, ellipsoidal and rounded at the apex, with a truncate base, where they are attached to the intercalary cell (Figs. 1B, 2, 3). The apex of each end cell has a single germ pore. Both end cells have 2-4 gelatinous appendages surrounding the germ pore; these appendages are hyaline, tapering, straight, curved or flattened, 16-20 X 6-7.5 µm, sometimes split into filaments or with a longitudinal furrow (Fig. 2). Small appendages of irregular size and shape are also attached near the septa between the intercalary and the end cells. The gelatinous appendages do not swell in water. Intercalary cell slender, 177 X 7.5 µm, cylindrical, occasionally multiseptate, sometimes slightly inflated in the middle, usually with small patches of mucus sparsely distributed over the cell (Figs. 2, 3). Mature ascospores up to 220-230 µm in length, straight or spirally coiled around each other, arranged on about the same level in the ascus (Fig. 1C).

Conidia were not observed.

Isolated from calf dung collected at Burro Negro (Black Donkey), Pica-Pica County, Baralt, Zulia State, Venezuela.

DISCUSSION

As with most coprophilous ascomycetes, the biology of *Zygopleurage zygospora* is poorly understood. Lundqvist (1969) states that the fungus seems to belong mainly to warm-temperate and subtropical regions. However, it has been reported from northern Europe, Canada (Cain, 1934) and the United States (Griffiths, 1901), the Caribbean, Southeast Asia (Boedijn, 1962) and Pakistan (Ahmed and Asad, 1968), as well as from northern Africa and now from northern South America. This represents the first report of *Z. zygospora* in Venezuela. It appears to occur preferentially on the dung of domesticated herbivores, including camel, cow, donkey, goat, guinea pig, hare, horse, pig, rabbit, and sheep, but this may be an artifact of the collecting habits of mycologists rather than a natural phenomenon.

Based on our observations, perithecial development takes 10-14 days. This is in agreement with the 10 days reported by Griffiths (1901) but contrasts with the 3-4 weeks indicated by Lundquist (1969). Such variations may reflect differences in the age and condition of the materials sampled.

Zygopleurage is classified in the Lasiosphaeriaceae (Eriksson and Hawksworth, 1993; Lundqvist, 1972) of the Sordariales, primarily on the nature of the ascospore. In most of the genera the ascospores have both pigmented and hyaline cells and possess gelatinous appendages of different types. Lundqvist (1969) considers *Zygopleurage* closely related to *Lasiosphaeria*, which has elongate, hyaline to yellowish ascospores. The elongate hyaline cell in *Zygopleurage*, which is sometimes septate, and the manner of ascospore delimitation, are considered evidence that it evolved from a spore like that in *Lasiosphaeria* (Lewis, 1911). Lundqvist (1969) considers the development of pigmented cells an adaptation

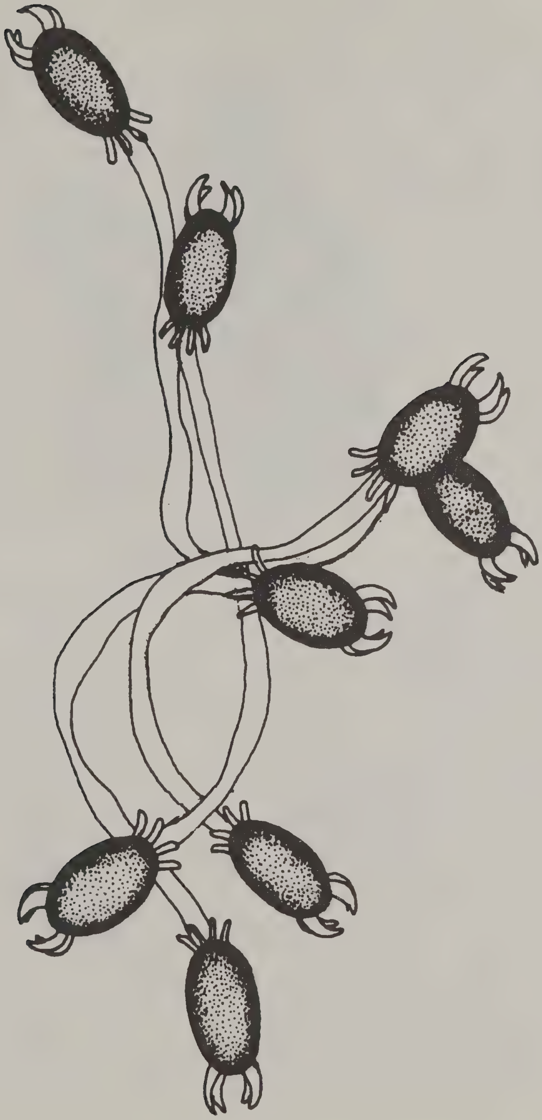

Figure 2. Cluster of ascospores of *Zygopleurage zygospora* with pigmented end cells with gelatinous caudae connected by a slender, hyaline, connective.

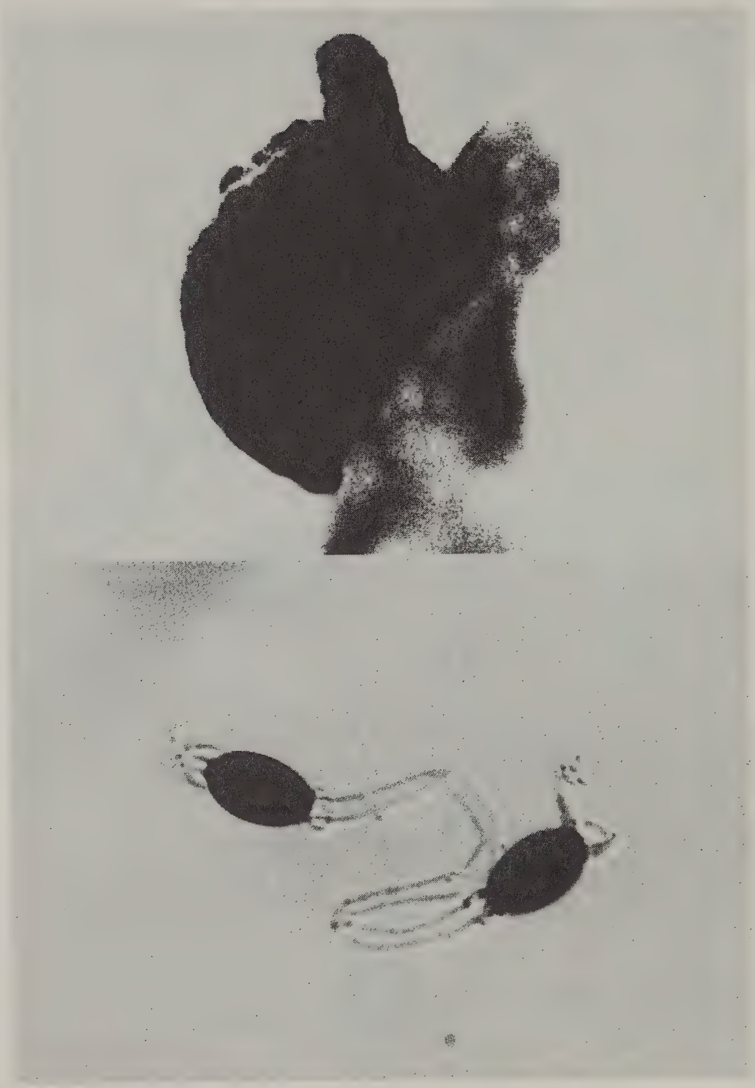

Figure 3. *Zygopleurage zygospora*. Top, Perithecium on dung. Bottom, Mature ascospore.

to the coprophilous habit. The unusual ascospore in *Zygopleurage* is considered advantageous to the fungus in spore dispersal, as the elongate spore is weighted at the ends and thus functions like a bola upon discharge, facilitating its entanglement with grass leaves.

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SEVERAL RUSSULAS OF THE CHIRICAHUA MOUNTAINS

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ABSTRACT

Two new species of *Russula*: *R. cochisei* and *R. cinereopurpurea*, recently collected in the Chiricahua Mountains, Cochise County, Arizona, are described along with an illustrated redescription of *R. atroviolacea*.

INTRODUCTION

An ongoing study of the mycoflora of Arizona's Chiricahua Mountains, Nishida et al. (1992), includes many collections of *Russula* which do not conform with published descriptions. A few have been collected repeatedly during the course of the study and apparently are fairly common in this habitat. One seemed close to Burlingham's published description of *R. atroviolacea* but a comparison with the type proved otherwise. A redescription of the type is presented to provide illustrated microscopic characters along with the description of the new species, *R. cinereopurpurea*. Another commonly occurring taxon being described, *R. cochisei*, was macroscopically similar to *R. alutacea* but chemical reactions and microscopic observations quickly differentiated it.

MATERIALS AND METHODS

Color terms and designations used in the following descriptions are cited from Maerz & Paul (1950), e.g., M&P 7L12, or from the ISCC-NBS system (Kelly & Judd, 1955), e.g., 54 brownish Orange. Otherwise, color names are the author's concept of general color hues. The massed spore color designated by a capital letter from A to H refers to the spore color code of Pearson (1950), or designated by a Roman numeral alphabetical combination, e.g., IVe, refers to Romagnesi's (1967) color code. Spores were examined mounted in Melzer's reagent, size determined in lateral view, with ornamentation excluded. Other microscopic descriptions were made from sections mounted in 3% KOH and 10% NH_4OH. Illustrations were made with the aid of a drawing tube. The pileus was studied from tangential sections.

TAXONOMY

Russula cochisei Fatto, sp. nov. Figs. 1-3

Pileus 5-10 cm latus, convexus, maturans ad plano-depressum; margo aequus, aetate leviter striatulus; cutis separablis usque ad 2/3 partes radii, glabra, rubra gravis et sordida, trama alba, tenuis, firmus, immutans; odor nullus; sapor mitis. Lamellae adnatae, modice confertae, aequae, ochraceus. Stipes ad 7 x 2.5 cm, glabrus, albus, saepe areas roseas forte. Sporae ochraceae, (Romagnesi IVe), (8.0-)8.8-10.4(-11.2) x (6.4-)6.8-8.8(-9.2) µm, flocculae 0.4-1.0 µm altae, separatae aut cum paucis et brevibus connectivis. Cystidia hymenialia 56-104 x 8-15 µm, variabilis, fusiformia, sub-cylindrica, fusoidia-clavata, area superior cum contento recurvato et granulato. Pileus subcutis habens libratas-contextas hyphas 2-4 µm latas. Pileus epicutis ixotrichodermis hypharum hyalinarum filimentosarum et 3-8 µm lata subcylindrica pileocystidia cum oleiferis extremis hyphis.

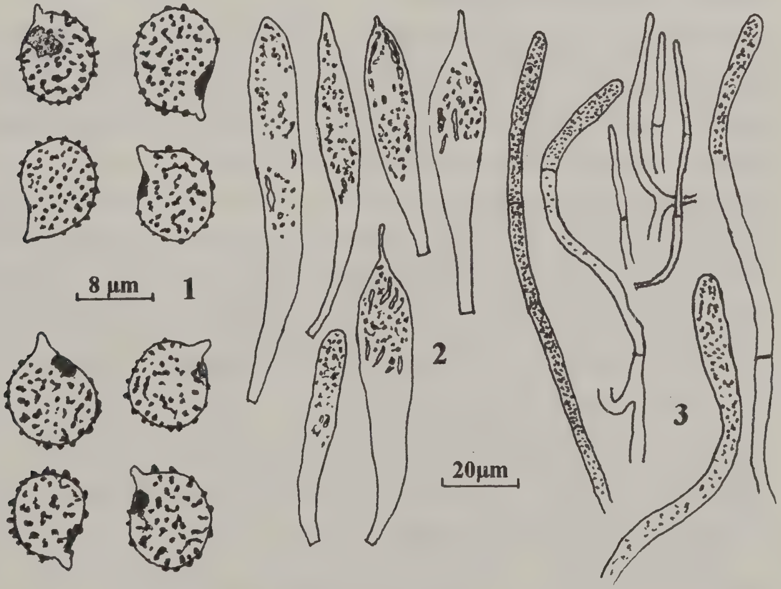
Holotypus: Lectus a R. M. Fatto 820 (CM-3774) in Arizona, Cochise County, Chiricahua Montibus, altitudo 1950 m (6400 ft), sub pino, 24 Aug 1994, positus in herbario Los Angeles County Museum (LAM).

Pileus 5-10 cm broad, convex when young, plano-convex to plane with a shallowly depressed disc in age; margin even becoming tuberculate-striate to 5 mm from the edge inward in age; cuticle viscid when wet, dull when young but displaying a sheen or silkiness when older, glabrous, sometimes slightly rugulose, separable 1/3-2/3 of the radius, dull deep red between 16 dark Red and 43 moderate reddish Brown, M&P 6L5, 7H6, usually fairly evenly colored or the disc slightly deeper but occasionally fading to an ochre-orange approaching 54 brownish Orange or M&P 5F11; trama thin, about 2 mm at mid-radius, red to pink under the cuticle, otherwise white, unchanging, firm, odor none, taste mild. **Lamellae** 7-9 mm broad at mid-radius, ventricose to rounded in front, adnate, moderately close to subdistant, generally equal but on occasion with a few long lamellulae, or some forking or anastomosing near the stipe, brittle, edges even, taste mild, ochraceous, unchanging when injured. **Stipe** 3-7 cm long, 1-2.5 cm wide at midpoint, normally enlarging towards the base, surface dry, glabrous, longitudinally rugulose, white, often with small to large random areas of pink, unchanging when injured but slowly staining brownish after handling; trama firm becoming spongy, white, unchanging.

Chemical reactions (stipe trama): sulphovanillin (SV) none; 10% $FeSO_4$ none to faintly brownish; 2% phenol slowly to dark brown; formalin none; guaiac deep greenish blue.

Spores ochraceous in mass, H or IVe, (8.0-)8.8-10.4(-11.2) x (6.4-)6.8-8.8(-9.2) µm, average Q=1.22, broadly elliptic or broadly obovate; ornamentation of amyloid convex to conic warts 0.4-1.0 µm high, isolated, connate, or catenulate, an occasional line or thin ridge connecting 3-4 warts, without any closures; suprahilar area a weakly amyloid patch containing darker fine particles. **Basidia** 34-54 x 12-17 µm, clavate, 4-sterigmate. **Hymenial cystidia** 56-104 x 8-15 µm, very variable, fusiform, subcylindric, fusoid-clavate, occasionally ventricose-rostrate, apices rounded, acute, acuminate, mucronate, appendiculate, lower half empty, upper portion with varying amounts of banded or granular refractive content, SV+, arising from the subhymenium or trama, projecting to 40 µm beyond basidioles, common. **Subhymenium** 26-45 µm thick, pseudoparenchymatous, cells 4-10 µm wide. **Lamellar trama** with rare, SV-, clear vascular hyphae 4-8 µm wide. **Pileus subcutis** 90-130 µm thick, of horizontal- to ascending-interwoven, hyaline filamentous hyphae 2-4 µm wide; also with common oleiferous hyphae 3-8 µm wide and some smooth vascular hyphae. **Pileus epicutis** 50-70 µm thick, embedded in a gelatinous matrix, hyaline, ascending to erect hyphae 1.5-3 µm wide, apices rounded; also with pileocystidia 3-8 µm wide, septate, partially filled with refractive-grayish granular content, weakly SV+, cylindric to subclavate, usually obliquely oriented, as ends of oleiferous hyphae ascending from the subcutis, common. **Stipe cuticle** a thin layer of longitudinal-interwoven, nongelatinous, septate, branched, hyaline hyphae 2-4 µm wide, also with common embedded oleiferous hyphae 2-8 µm wide, containing refractive-grayish granules, weakly SV+, some of which project to 60 µm from the surface as caulocystidia .

Habitat solitary in soil under various pines, such as Chihuahua (*Pinus leiophylla* var. *chihuahuana*), Arizona (*Pinus ponderosa* var. *arizonica*), and Apache (*Pinus engelmannii*), usually above 5800 ft. elevation; August.



FIGS. 1-3. *Russula cochisei* (Fatto 820, CM-3774, holotype). 1. Spores. 2. Hymenial cystidia. 3. Hyphal ends from pileus cuticle.

MATERIAL EXAMINED: ARIZONA: Cochise Co.: Chiricahua Mtns.: Barfoot Park, 25 Aug 1994, Fatto 827, (CM-3783); 21 Aug 1996, Fatto 978, (CM-4671); 19 Aug 1998, Fatto 1170, (CM-4073); intersection of Pinery Canyon and Turkey Creek Roads, 24 Aug 1994, Fatto 820, (CM-3774) (Holotype, LAM; Isotype, NY); Pinery Canyon Campground, 29 Aug 1993, Nishida 5151, (CM-3041); Pinery Canyon Road, 2.6 mi. NW of Southwestern Research Station, 17 Aug 1998, Fatto 1166, (CM-4055). Note: The Chiricahua Mycoflora (CM) collection numbers in parentheses refer to collections stored at LAM; portions of the collections are in RMF personal herbarium.

OBSERVATIONS: Macroscopically, *Russula cochisei* has no unusual distinguishing features. The conventional stature, dull deep red pileus color which tends to fade, close to subdistant ochre lamellae, white stipe with occasional patches of pink, mild taste and lack of odor are characteristics of several species of *Russula* in the Chiricahua mountains. *Russula* fruitings in 1994 and 1998 were better than normal and several collections from the same areas were visually separated only by the application of phenol to the stipe. The reaction on *R. cochisei* was slowly to a deep brown while a striking plum violet occurred on others which proved to be *R. alutacea*. Microscopically *R. cochisei* has relatively large spores, 9.6 x 7.8 µm, ornamentation 0.8 µm high with few connectives and a pileus cuticle with narrow (2 µm) filamentous hyphae and cylindric pseudocystidia. Whereas *R. alutacea* has spores averaging 8.5 x 7.2 µm with warts 0.5-0.6 µm high with many ridges and connectives and a pileus cuticle consisting of 5 µm wide, multi-septate, often constricted hyphae and no pileocystidia.

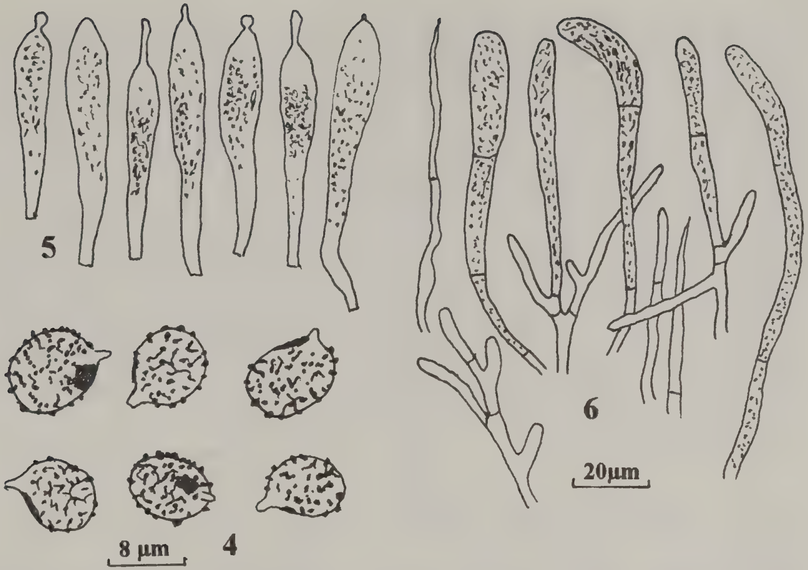
Russula cochisei is placed in section *Coccineae* Romagnesi, subsection *Laetinae* Romagnesi which contains mild, red-capped *Russulas* with deeply colored spores and the species are separated by the details of the pileus cuticle. It is named after Cochise, the renowned Chief of the Chiricahua Apache tribe. Previous reference to this species in the Chiricahua mycoflora collections was "Russula C2".

Russula cinereopurpurea Fatto, sp. nov. Figs. 4-6

Pileus 3-9 cm latus, convexus, maturans ad plano-depressum; margo aequus, aetate striatulus ad 10 mm intorsum; cutis splendens, glabra, separabilis ad 1/2 partem radii, sordida cinereopurpurea; trama tenuis, alba, immutans; odor sine descriptione, indistinctus; sapor lente acer. Lamellae adnatae, confertae, aequae, pallidae-ochraceae. Stipe ad 6 x 1.5 cm, glabrus, albus. Sporae ochraceae (Romagnesi IVc), 7.2-9.6 x 6.0-7.6 µm, flocculae tenues, 0.3-0.7 µm altae, cum paucis et gracilibus connectivis. Cystidia hymenialia 46-68 x 8-12 µm, fusoidia-clavata, appendiculata, habens subtiles et recurvatas et granulatus particulas modo in media parte. Pileus subcutis habens libratas-contextas hyphas. Pileus epicutis ixotrichodermis hypharum hyalinarum filimentosarum et abundantia pileocystidia septata, cylindrica ad clavata, 4-8 µm lata.

Holotypus: Lectus a F. H. Nishida & R. M. Fatto 1175 (CM-4070), in Arizona, Cochise County, Chiricahua Montibus, altitudo 2400 m (7900 ft), sub pino, 19 Aug 1998, positus in herbario Los Angeles County Museum (LAM).

Pileus 3-9 cm broad, convex, aging plano-depressed; margin even, in age becoming



FIGS. 4-6. *Russula cinereopurpurea* (Fatto 1175, CM-4070, holotype). 4. Spores. 5. Hymenial cystidia. 6. Hyphal ends from pileus cuticle.

tuberculate-striate to 10 mm inwards; cuticle viscid when wet, with a high sheen or shiny when dry, glabrous, separable 1/3 to 1/2 the radius, deep grayish purple to violet, hues from 46 grayish reddish Brown, M&P 7J7 to 20 dark grayish Red or 242 dark reddish Purple, M&P 56J7, disc tones grayer and marginal area brighter; trama thin, 2 mm at mid-radius, firm, white, unchanging when injured, odor none or faintly nondescript, taste slowly acrid. **Lamellae** 5-8 mm broad at mid-radius, rounded in front, adnate to adnexed, close, equal, often with some basal forking, brittle, edges even, cream when young but soon pale ochre. **Stipe** 4-6 cm long, 1-1.5 cm wide at midpoint, enlarging downward, dry, glabrous, slightly longitudinally rugulose, white, stuffed, unchanging when bruised.

Chemical reactions (stipe surface and trama): SV none; 10% $FeSO_4$ none to weak tan; 2% phenol slowly to deep purplish brown; formalin none; guaiac greenish blue.

Spores ochraceous in mass, G or IVc, 7.2-9.6 x 6.0-7.6 µm, average Q = 1.25, broadly obovate to broadly elliptic; ornamentation of amyloid warts 0.3-0.7 µm high, isolated, catenulate, short ridges, a few lines, occasionally forming a closure but not a reticulum; suprahilar area a moderately amyloid patch; hilar appendix inamyloid, conspicuous. **Basidia** 36-48 x 10-12 µm, narrowly clavate, normally 4-sterigmate but some 2-sterigmate observed. **Hymenial cystidia** 46-68(-80) x 8-12 µm, fusoid-clavate, apices acute to rounded, mucronate, capitellate, appendiculate, appendage to 10 µm long, contents of granular particles or a few short bands primarily in the central area, apical and basal areas usually empty, weakly SV+, arising from the subhymenium, embedded or projecting to 16 µm, rarely to 24 µm, scarce to common. **Subhymenium** 40-70 µm thick, pseudoparenchymatous, cell diameter 6-22 µm. **Lamellar trama** apparently without vascular hyphae. **Pileus subcutis** 50-80 µm thick, horizontal-interwoven, tightly compressed, filamentous hyphae 1-4 µm wide; also with common granular oleiferous hyphae 3-6 µm wide and rare clear vascular hyphae 2-4 µm wide. **Pileus epicutis** 100-120 µm thick, embedded in a gelatinous matrix which is quite transparent and soon dissipates in KOH, ascending to erect hyaline hyphae, septate and frequently branched, 2-4 µm wide, apices rounded, a few acuminate; also abundant pileocystidia, cylindrical to clavate, 0-4 septate, contents refractive granular, moderately SV+, 30-150(-220) x 4-8(-10) µm, arising from the connective hyphae and also as terminations of the oleiferous hyphae arising from the subcutis. **Stipe cuticle** of longitudinal-interwoven, hyaline, septate, branched hyphae, 2-4 µm wide, with very few projecting ends; also with appressed to projecting caulocystidia, 44-75 x 6-10 µm, aseptate, subcylindric to clavate, with granular content, weakly SV+, singular or clustered, common.

Habitat solitary to scattered on soil under pine, elevation above 6900 fee; August.

MATERIAL EXAMINED: ARIZONA: Cochise Co.: Chiricahua Mtns.: Barfoot Park, 23 Aug 1992, S. B. Fleming, (CM-1972); 21 Aug 1996, Fatto 1090; Onion Saddle, 24 Aug 1991, F. H. Nishida 4648, (CM-1598); 19 Aug 1998, F. H. Nishida & Fatto 1175, (CM-4070) (Holotype, LAM; Isotype, NY); Pinery Canyon Campground, 19 Aug 1996, F. H. Nishida, (CM-4654); Rustler Park, 21 Aug 1996, Fatto 1089, (CM-4668); 21 Aug 1997, Fatto 1075.

OBSERVATIONS: *Russula atroviolacea* seemed near to *Russula cinereopurpurea* but its Colorado habitat, under willows, rather than ponderosa pine of the Arizona collections suggested that it was different. The holotype of *R. atroviolacea* was examined. It is similar to the Arizona collections in appearance and color, however there are substantial microscopic differences. Spores of *R. atroviolacea* are, on average, 8.8 x 7.2 µm with prominent, wide warts to 1.2 µm high and few connectives. Spores on *R. cinereopurpurea* are slightly smaller, 8.4 x 6.8 µm with fine warts to 0.7 µm high and frequent fine connectives. Hymenial cystidia are strikingly different. On *R. atroviolacea* they are numerous, prominently projecting beyond the basidioles, and contain an appreciable amount of large refractive granules and bands. *Russula cinereopurpurea* has short cystidia, normally embedded or difficult to locate with only the apices or appendages projecting and contain a small amount of fine refractive particles. The pileus cuticle of *R. atroviolacea* contains wider pileocystidia, (7-16 µm) as compared to the 4-9 µm width of those of *R. cinereopurpurea.* These consistent differences preclude any equivalence. This taxon is placed in Singer's (1986) section *Russula*, subsection *Urentinae* for its acrid taste, deep ochraceous (G) spore color, and the numerous, long, multiseptate pileocystidia. Previous collections of this taxon are labeled "Russula C7" as an unknown *Russula* species in the Chiricahua mycoflora collections.

Russula atroviolacea Burlingham, North American Flora 9:220. 1915. Figs. 7-9

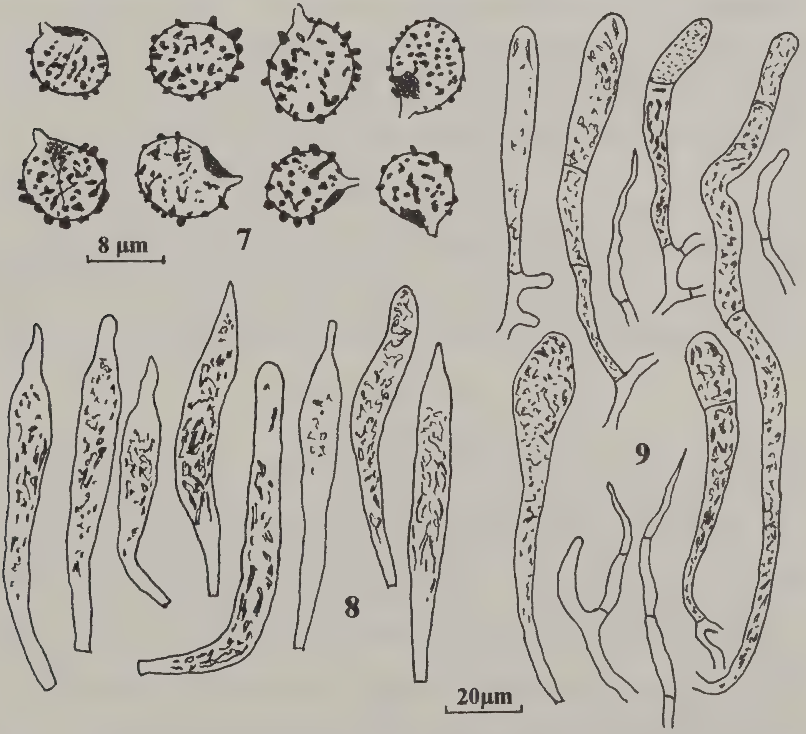
Holotype: L. O. Overholts 1909, 14 Jul 1914, elev. 9000 ft., Tolland, CO, PS433 (PACMA).

Burlingham's original published description: "Pileus convex, then plane and depressed in the center, 4-9 cm. broad; surface haematite-red or diamine-brown, uniformly colored or rarely lighter in the center, viscid when wet, with separable pellicle, glabrous; margin even; context fleshy, solid, not fragile but thin, purplish under the cuticle, otherwise white, tardily and slightly peppery; lamellae cream-colored, darker with age or in drying, mostly equal, branching somewhat next to the stipe, interspaces venose, rather close, adnate, 6-10 mm. broad; stipe equal or slightly larger below, white, not discolored, slightly pruinose to glabrous, solid, becoming hollow, at least at the base, 4-6 cm. long, 1.5-2 cm. thick; spores ochraceous, globose, echinulate, 7-10 μ in diameter.

Type collected on the ground under willows at Boulder Park, Tolland, Colorado, 2775 m. elevation, July 14, 1914, *L. O. Overholts 1909* (herb. Overhholts; extype herb. Burlingham).

Distribution: Known only from the type locality."

The type collection consists of 3 and 1/2 specimens in good condition.



FIGS. 7-9. *Russula atroviolacea* (L. O. Overholts 1909, PS433). 7. Spores. 8. Hymenial cystidia. 9. Hyphal ends from pileus cuticle.

Spores 7.6-10.0 x 6.4-8.0 µm, average Q = 1.21, broadly obovate, broadly elliptic; ornamentation of amyloid, broadly convex to cylindrical warts 0.6-1.2 µm high, mostly isolated but short catenulate or a short ridge evident on many spores, fine lines infrequent, without any closures; suprahilar area a weakly to moderately amyloid patch; hilar appendix inamyloid, inconspicuous in Melzer's. **Basidia** 36-54 x 10-14 µm, clavate, 4-sterigmate. **Hymenial cystidia** 70-94 x 9-12 µm, fusoid, subcylindric, fusoid-clavate, apices narrowly rounded, acuminate, rostrate, content granular, banded, some areas empty, presently SV-, arising from subhymenium or edge of trama, projecting to 34 µm beyond basidioles, common to numerous. **Subhymenium** 30-50 µm thick, pseudoparenchymatous, cell diameter 6-12 µm. **Lamellar trama** with smooth vascular hyphae 2-9 µm wide. **Pileus subcutis** 90-140 µm thick, tightly compressed, horizontal-interwoven hyphae 1-4 µm wide, also with oleiferous hyphae. **Pileus epicutis** 80-140 µm thick, embedded in a gelatinous matrix, ascending to erect, septate, hyaline hyphae 1-4 µm wide, terminal cells aculeate, acuminate or with rounded apices; also with abundant pileocystidia, subcylindric to clavate, 0-2 septate, 40-110 x 7-16 µm, with granular to banded refractive contents, weakly SV+, and ascending ends of oleiferous hyphae 6-10 µm wide. **Stipe cuticle** of longitudinal-interwoven, septate, branched, hyaline hyphae 2-5 µm wide and scattered or more often clustered, appressed or slightly projecting cylindrical to subclavate caulocystidia as apices of granular oleiferous hyphae 4-10 µm wide; also with embedded smooth vascular hyphae 4-6 µm wide.

Singer (1942), type study, placed this species in subsection *Urentinae*.

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A redescription of Omphalina meridionalis, based on material collected in Spain

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Summary: A redescription is made of *Omphalina meridionalis*, a lichenized agaric with *Botrydina* thallus, recently described from Sardinia (Italy). Since lichenization in *Omphalina* is connected to a loss of clamps and of a pure tetrasporic state, several Spanish collections have been compared with the holotypus. The former is clampless and shows both bi- and tetrasporic basidia. In addition, and contrary to the original description, the holotype is also devoid of clamps. A taxonomic discussion, mainly related to morphological and ecological differences of *O. meridionalis* with the other lichenized European *Omphalina* species, is also provided. The new combination *Omphalina aurantiaca* is also proposed.

Key words: *Tricholomatales*, *Omphalina*, *Phytoconis*, *Omphalina meridionalis*, lichenized agarics, Spain

INTRODUCTION

The genus *Omphalina* is considered nowadays a taxon within the *Tricholomataceae* (HAWKSWORTH et al., 1995), with lichenized and non-lichenized members having small basidiomata with applanate to umbilicate pilei, frequently with crenate margin, decurrent and distant lamellae and white to yellowish spore print. However, the taxonomy of this genus has generated a controversy during the last two decades not only for its generic delimitation (BIGELOW, 1970; REDHEAD & WERESUB, 1978; LANGE, 1981; CLÉMENÇON, 1982; KUYPER, 1986; SINGER, 1986), but also around its nomenclatural aspects, mainly related to those lichenized species (REDHEAD & KUYPER, 1987; 1988). The genus *Omphalina* was proposed to be either typified with *O. pyxidata* (Bull.: Fr.) Quél. (REDHEAD, 1993) or *O. epichysium* (Pers.: Fr) Quél. (REDHEAD & KUYPER, 1993) and a number of lichen names based on the imperfect stage *(Phytoconis* Bory, *Botrydina* Brébisson and

Coriscium Vain) are now considered as *nomina rejecta* for the perfect stage (JØRGENSEN & RYMAN, 1989; HAWKSWORTH *et al.,* 1995).

On the basis of morphological characters, lichenized omphalinoid species were suggested to form a monophyletic group (KUYPER, 1986; REDHEAD & KUYPER, 1987), an hypothesis later confirmed by phylogenetic studies using molecular data (LUTZONI, 1997) or combining both, morphological and molecular data (LUTZONI & VILGALYS, 1995 a, b). Besides, these phylogenetic analysis suggest a single transition from saprotrophic to mutualistic lineage, in which *O. epichysium* and *O. ericetorum* could represent, respectively, the basal members of each clade (LUTZONI, 1997). Several features as the loss of clamps, loss of a pure tetrasporic state, loss to ability to grow in pure culture and the development of a mononucleate teleomorph, have been proposed to be associated to lichenization in the genus *Omphalina* (LUTZONI & VILGALYS, 1995 b). The monophyletic arrangement for lichenized species of *Omphalina* agrees with the taxonomic treatment proposed by REDHEAD & KUYPER (1988) and KUYPER (1995) in that way that it suggests a generic status (*Phytoconis*) for the lichen clade, not only based on lichenization, but also on the lack of clamps and the structure of the hymenophoral trama. However, such a taxonomical treatment would imply splitting up the genus much further and recognizing many omphalinoid genera, like *Chromosera* Redhead, Ammirati & Norvell and *Jacobia* Contú, recently segregated from *Omphalina* (REDHEAD & *al.* 1995; CONTÚ, 1997). In order to strenghthen the nomenclatural stability among *Omphalina* species, the maintenance of lichenized and non lichenized species within the same genus has been suggested by LUTZONI (1997).

Recently, a new lichenized species with *Botrydina* thallus, named *O. meridionalis* Contú & La Rocca, was described from Sardinia (Italy) fruiting in winter period (CONTÚ & LA ROCCA, 1999). This taxon was described with clamped basidia and extracellular pigment. Since phylogenetic analysis have demonstrated that lichenization in *Omphalina* species is associated, among other characters, with the loss of clamps (LUTZONI & VILGALYS, 1995 b), a revision of the type material of this taxon has been carried out in the present work. The results of this study revealed the total absence of clamps in the type material, as well as the presence of extracellular pigment, which together with the completely velutinous stipe would place this taxon close to *O. velutina*. A variation from tetrasporic to bisporic and monosporic basidia, observed in the Spanish collections, is also proposed for *O. meridionalis*.

MATERIALS AND METHODS

The redescription of *O. meridionalis* has been based on a study of the holotypus, which was requested on loan from (IB), and three collections from Spain containing more than 40 specimens. The microscopical study, including microphotographs, was carried out with an Olympus BX50 using bright field and phase contrast. The macroscopic photographs were made in an Olympus SZ-PT stereo-microscope. Colour terms are referred to MUNSELL (1994) and spore measurements are given according to the method proposed by HEINEMANN & RAMMELOO (1985).

The collections of the Spanish material have been deposited at the Herbarium of the Departamento de Biología Vegetal, Universidad de Alcalá, Spain (AH).

Omphalina meridionalis Contú & La Rocca, *Fungi non Delineati* 9: 32-33, 1999 (Figs 1-7)
= *Omphalina hiemalis* Barrasa & Esteve-Rav., Abstracts XIII Congress of European Mycologists: 10, 1999 *-ad interim-*.

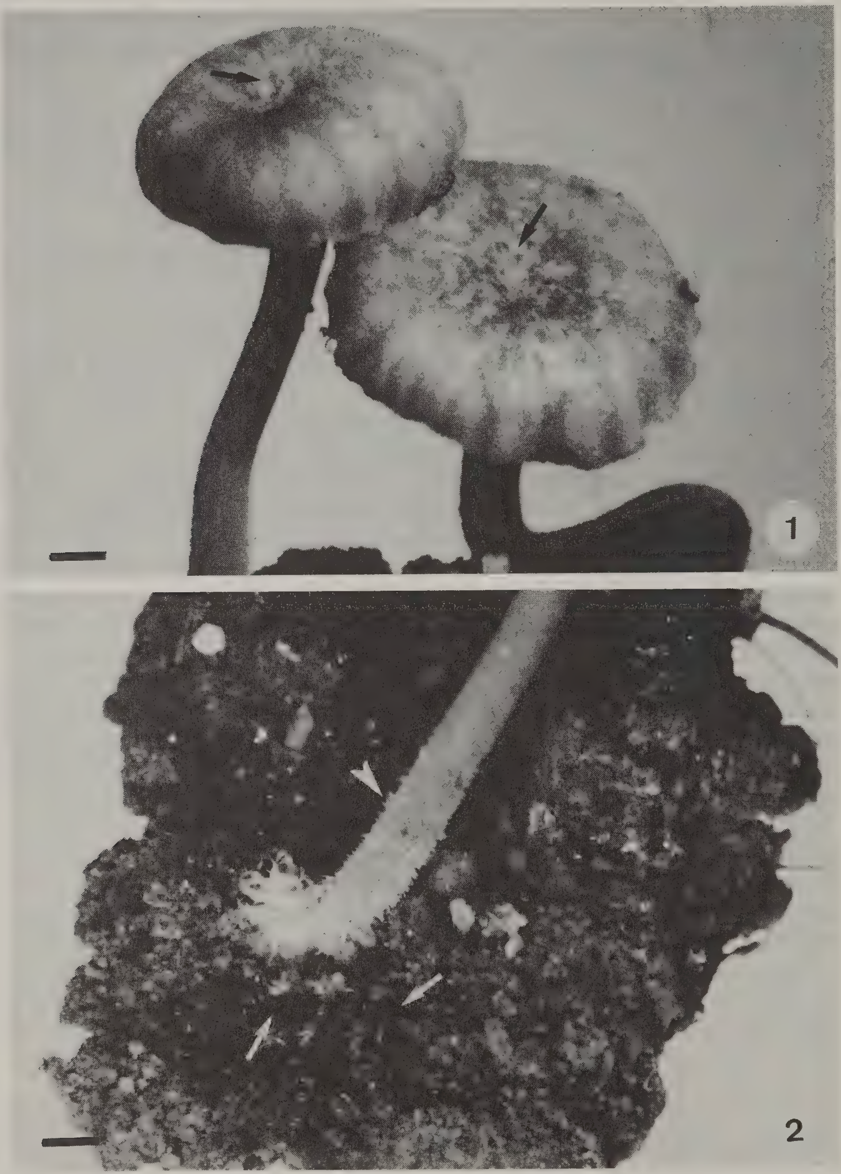
Fruitbodies omphalinoid, gregarious. *Pileus* 4-8 mm diam., convex to applanate, with involute margin; surface fibrillose or pruinose especially at the disc (Fig. 1), first translucent striate, colours yellowish red (5YR 5/6, 5YR 5/8), becoming pallid orange-argillaceous (7,5YR 6/4, 7,5YR 6/6); *lamellae* shortly decurrent, arcuate, distant, narrow, 1-2 mm broad, only occasionally forked, not anastomosing, pallid, concolorous or slightly paler than pileus (5YR 5/6), orange-argillaceous (mainly in edge) becoming orange buff to beige on drying (5YR 6/6 to 5YR 7/4, 5YR 7/8). *Lamellulae* absent. *Stipe* 5-20 mm long, 0.5-2 mm diam, cylindrical often slightly curved, cartilaginous, surface highly velutinous throughout, base with white mycelial patch (Fig. 2), concolorous with pileus (5YR 4/6 to 5YR 5/6 or 5/8) turning darker on drying (7,5YR 5/6 to 7,5YR 6/6). *Spores* (7)7.6-9.3-11 x 4-5-6 μm, Q=1.5-1.9-2.3 (n=30), cylindrical to ellipsoid, slightly ventrally depressed in profile view, smooth, thin-walled, hyaline, inamyloid, uni or biguttulate, with prominent apiculus (Fig. 5). *Basidia* 20-30 x 5-6 μm, cylindrical to narrowly clavate, frequently sinuose, four to two-spored or rarely monosporic, clampless, the sterigmata 4-6-(8) μm long (Fig. 4). *Hymenial cystidia* not observed. *Lamellar trama* irregular, similar to the context hyphae, 4-6 μm diam, with diffuse intraparietal pigment. *Pileipellis* a cutis to subtrichodermium, the suprapellis made of cylindrical hyphae (Fig. 3), 5-15 μm diam, constricted at the septa, with cylindrical to clavate terminal elements; pigment intraparietal, slightly encrusting in the subpellis and narrow hyphae, but never forming "zebra strips". *Stipitipellis* hyphae similar to those of pileipellis, bearing caulocystidia which form the velutinous covering, 100-120 x 4-6 μm, in tufts (Fig. 6). *Botrydina* thallus constituted by lichenized granules 20-55 μm diam with subtending thin-walled hyphae 2-4 μm diam (Fig. 7). *Clamps* absent in all tissues.

Material studied.

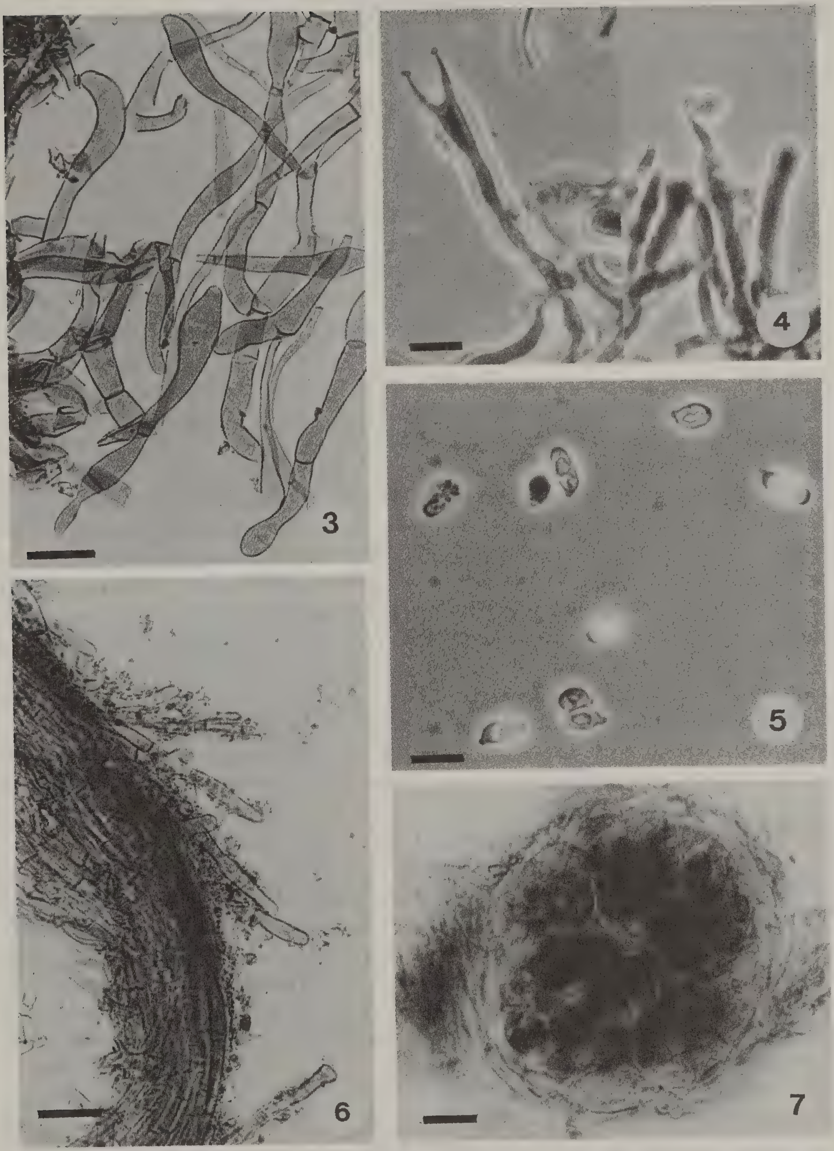
Italy: Sardinia, Prov. Sassari, Tempio-Opchiri, 10 Jan. 1999, zona parafuoco, lichenisata, Leg./Det. M. Contú, IB- 1999/0879 (Holotypus). **Spain**: Segovia, Fresno de Cantespino (Prado Pinilla), 1050 m, 30TVL5576, in bare acid soil in open vegetation of *Cistus laurifolius* (*Cistaceae*), 16 Jan. 1999, leg. J. M. Barrasa & B. Fano, AH 25152. *Ibidem*, 31 Dec. 1998, AH 25153. *Ibidem*, 24 Jan 1999, AH 25154. Ibidem, 29 Dec 1999, AH 25359.

Additional material examined for comparison.

Omphalina ericetorum (Pers.: Fr.) M. Lange ex Bigelow
Spain: Madrid, puerto de Canencia, Arroyo del Sestil de Maillo, 1400 m, 30TVL3425, 7 March 1995, *Betula* forest, in a river bank among mosses and plant debris, leg. C. Navarro & V. J. Rico, Rico nº2974. Girona, Setcases, Bac de Carboner, 29 Aug. 1998, on rotten wood of *Abies alba*, leg. J. Vila, J. Llistosella, X. Llimona & F. Esteve-Raventós, AH 25059, duplo in Herb. J. Vila.



Figs 1-2 *Omphalina meridionalis* (AH 25152). **Fig. 1.** Fruitbodies showing fibrillose pilei (arrows). **Fig. 2.** White mycelial patch at the base of the stipe with *Botrydina* thallus (arrows) and velutinous stipe (arrowhead). Bars = 2 mm.



Figs. 3-7. *Omphalina meridionalis* (AH 25152). **Fig. 3.** Hyphae of the pileipellis showing terminal clavate elements. **Fig. 4**. Bisporic and monosporic basidia. **Fig. 5**. Spores. **Fig. 6**. Hairs in tufts of the stipitipellis. **Fig. 7**. Lichenized granule of *Botrydina* thallus. Bars: Figs 3 and 6 = 10 µm; Figs 4,5 and 7 = 8 µm.

Omphalina velutina (Quél.) Quél.

Portugal: Alto Douro, Tras-os-Montes, between Rabal and França, 600 m, 29TPG8738, 21 Oct. 1999, on soil of *Quercus ilex* forest, among mosses and plant debris, leg. V.J. Rico, Rico nº3476.

Spain: Segovia, Fresno de Cantespino, 1050 m, 30TVL5576, 31 Oct. 1998, on acid soil, leg. J.M. Barrasa & B. Fano, AH 25331.

DISCUSSION

Only eight species of omphalinoid Tricholomatales are known to be lichenized and have been alternatively included either in *Omphalina* (BON, 1997) or *Phytoconis* (REDHEAD & KUYPER, 1988; COLLIN & LAURON, 1994; KUYPER, 1995). Two morphological types of lichen thalli have been considered (REDHEAD & KUYPER, 1987): a simple and globular thallus, named *Botrydina*, constituted by globose granules of hyphae surrounding algae, and a more complex, foliose, squamulose or disc-shaped thallus, named *Coriscium*. The species forming *Botrydina* are *Omphalina aurantiaca* (Redhead & Kuyper) Barrasa & Esteve-Rav., ***comb. nov.*** (Basionym: *Botrydina aurantiaca* Redhead & Kuyper, Arctic & Alpine Mycology 2: 334, 1987), *O. ericetorum* (Pers.: Fr.) M. Lange ex Bigelow, *O. luteovitellina* (Pilát & Nannf.) M. Lange, *O. velutina* (Quél.) Quél. and *O. meridionalis* Contú & La Rocca. The *Coriscium* type of thallus has been described in *O. hudsoniana* (H.S. Jenn.) Bigelow, *O. chromacea* (Cleland) T.W. May & A.E. Wood and *O. lobata* (Redhead & Kuyper) P.M. Jørgensen. *O. meridionalis* can be distinguished from the close *O. velutina, O. ericetorum* and other European species with *Botrydina* thalli on the basis of morphological and ecological features of the basidiomata.

From the morphological point of view, *O. luteovitellina* differs from *O. meridionalis* by the deep yellow colour of the pileus and gills and glabrous stipe. In addition, this taxon usually grows among mosses and lichens and on peaty soils, and seems to be mainly restricted to the arctic, boreal and alpine areas of North America and Eurasia (REDHEAD & KUYPER, 1987).

A large variability in morphological and ecological features has been described in *O. ericetorum* (HØILAND, 1987). *O. meridionalis* differs from this species in the velutinous stipe, spore shape and different type of pigment. *O. ericetorum* seems to be widespread in arctic and alpine regions of Europe and North America, and mosses (usually *Sphagnum*) or peaty soils (occasionally on decayed wood of conifers and deciduous trees) are, respectively, the most common habitats of this species (HØILAND, 1987; KUYPER, 1995); by contrast, *O. meridionalis* seems to be restricted to mediterranean areas.

The widespread *O. velutina* can be differentiated from *O. meridionalis* by the grey-brown to beige pileus, pallid to dark grey long decurrent lamellae and the presence of a strong extracellular encrusting pigment, forming “zebra strips” in the pileipellis. *O. velutina* was also gathered by the authors in autumn in the same geographical area where *O. meridionalis* was fruiting. However, basidiomata of *O. velutina* were mostly found on road-sides, unstable soils and banks, in agreement with the habitat usually reported for this species (GULDEN & JENSSEN, 1988; KUYPER, 1995). Furthermore, fructifications of *O. meridionalis* seem to be related with low temperatures since our collections and the type collection were gathered during the cold winter period since December to January, although these phenological observations need further study.

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STUDIES IN BACIDIA SENSU LATO (LICHENIZED ASCOMYCETES: LECANORALES) I. THE GENUS BAPALMUIA

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Abstract: The lichen genus *Bapalmuia* is emended and monographed. Sixteen species are assigned to the genus, seven of which being new to science: *Bapalmuia cacaotica* Kalb & Lücking spec. nova, *Bapalmuia confusa* Kalb & Lücking spec. nova, *B. costaricensis* Lücking & Kalb spec. nova, *B. halleana* Sérus. spec. nova, *B. lineata* Lücking & Kalb spec. nova, *B. sorediata* Kalb & Lücking spec. nova, and *B. variratae* Sérus. spec. nova. *B. buchananii* (Stirt.) Kalb & Lücking comb. nova (= *Stereocaulon buchananii*), *B. callichroa* (Müll. Arg.) Kalb & Lücking comb. nova (= *Lopadium callichroum*), and *B. lafayetteana* (Vain.) Kalb & Lücking comb. nova (= *Bacidia lafayetteana*) are new combinations. *Bapalmuia kakouettae* Sérus. is excluded from the genus and *Byssoloma aptrootii* Sérus. is reduced into synonymy with it. *Bapalmuia* is characterized by biatorine apothecia with strongly convex disc and thin, usually evanescent margin, prosoplectenchymatous excipulum with radiating cell rows or with a labyrinthic structure, unbranched paraphyses, asci with an I+ darker tubular structure in the tholus, needle-shaped to narrowly cylindrical, multiseptate to submuriform ascospores, and small, unseptate, ellipsoid to fusiform conidia. 4,5-dichlorolichexanthone (= coronatone) is the major secundary product in all corticolous and muscicolous and in several foliicolous species. Because of apothecial anatomy and ascus structure, the genus is placed in the Pilocarpaceae. A key to all hitherto known species is provided.

Introduction

The genus *Bapalmuia* was established by SÉRUSIAUX (1993a) to accomodate the pantropical, foliicolous lichen *Bacidia palmularis* and a few supposedly related species. *Bapalmuia* was said to differ from *Bacidia* sensu stricto namely by the root-like mycelium at the apothecium base, the ascus structure, and the small, simple conidia. The tholus of *Bapalmuia* was given as lacking any distinct structure, but SÉRUSIAUX (1993b) and EKMAN (1996a) demonstrated the presence of an I+ darker blue tubular structure similar to that found in *Byssoloma* (HAFELLNER 1984).

In an earlier study, KALB (1984) had proposed that the tropical corticolous *Bacidia multilocularis*, despite the different ascospore septation, was congeneric with *Bacidia callichroa*, and described the new genus *Lopacidia* for them. Apparently, this genus agreed in all important aspects with *Bapalmuia*, and we were ready to place the latter into synonymy when we discovered that the identity of the type species of *Lopacidia*, *Bacidia multilocularis*, was misinterpreted. While the material distributed in the exsiccata series, MALME & SANTESSON: Lich. Austro-am. Exs. 238 and KALB: Lich. Neotrop. 5, represents a typical *Bapalmuia*, the type specimen of *Bacidia multilocularis* is congeneric with *Bacidina phacodes* (Körb.) Vezda. Thus, *Lopacidia* does not replace *Bapalmuia*, but is the oldest available name for a genus which has been recently described several times under different names: *Lichingoldia*, *Woessia* (both in HAWKSWORTH & POELT 1986) and *Bacidina* (VEZDA 1991), of which the latter has been proposed for conservation against *Lichingoldia* and *Woessia* (EKMAN 1996b).

During our studies, a number of additional species belonging in *Bapalmuia* has been found. In this paper, we emend the genus on the basis of more anatomical and chemical characters, and provide a survey of and a key to all known species.

Material and methods

This study is based mainly on the collections of the authors and relevant type and other material housed in several major herbaria. Messurements of anatomical details were performed in water mounted slides. The chemistry was analysed by TLC or HPTLC, using the standardized method by CULBERSON & KRISTINSSON (1970), CULBERSON (1972) and CULBERSON & JOHNSON (1982).

The genus *Bapalmuia*

Bapalmuia Sérus., Nord. J. Bot. 13: 449 (1993). – Type species: *Bapalmuia palmularis* (Müll. Arg.) Sérus. – Basionym: *Patellaria palmularis* Müll. Arg., Lichenes Epiphylli Novi: 10 (1890).

Description: Thallus corticolous, muscicolous or foliicolous, crustose, smooth to granulose-effuse or provided with thin verrucae or radiate ridges, sometimes with soralia or isidioid outgrowths, pale grey to greenish grey, often with a whitish or rather dark prothallus. Photobiont a species of Chlorococcaceae (probably *Trebouxia* spp.).

Apothecia biatorine, sessile, base distinctly constricted and often with a root-like whitish mycelium. Disc (flat to) strongly convex, orange brown to dark brown or black. Margin thin, usually disappearing, rarely persistent, chamois-coloured or pale grey. Excipulum prosoplectenchymatous, with radiating cell rows (textura oblita) and then externally sometimes with isodiametric cells, or rarely with a labyrinthic structure (textura epidermoidea) and then externally with short, free byssoid hyphae (Fig. 1). Hypothecium colourless to yellowish brown, rarely dark reddish brown or blackish brown. Epithecium indistinct or yellowish brown, sometimes encrusted with crystals, causing pruinose apothecial discs. Hymenium colourless, not inspersed. Paraphyses unbranched, apically not thickened. Asci cylindrical, tholus amyloid with an I+ darker blue tubular structure. Ascospores (4-) 8 per ascus, needle-shaped to narrowly cylindrical, transversely multiseptate to submuriform, uncoloured, not or slightly constricted at the septa, weakly halonate.

Pycnidia (found only in a few species) hemispherical to wart-shaped, often with a crater-like ostiolum. Conidia unseptate, ellipsoid to fusiform (*B. palmularis, B. nigrescens*, *B. halleana*), rarely bifusiform (a specimen tentatively assigned to *B. lafayetteana*). – Secondary chemistry homogenous, i. e. all corticolous and muscicolous (and some foliicolous) species contain 4,5-dichlorolichexanthone (= coronatone) (major) and lichexanthone (trace), but lichen acid deficient mutants do occur.

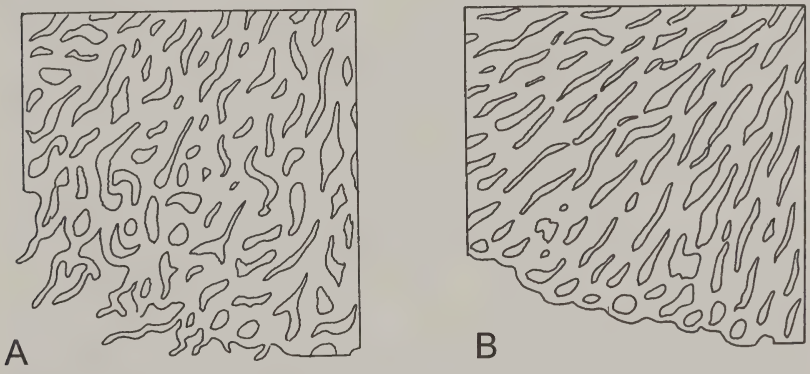

Figure 1: Excipulum structure in *Bapalmuia*. (A) *B. confusa* [Brazil, Malme 55 (S)], lateral excipulum with labyrinthic structure and free, byssoid outermost hyphae. (B). *B. lafayetteana* [TUR-Vainio 20800, lectotype], lateral excipulum with typically proso-plectenchymatous structure with radiating cell rows. Scale = 10 µm.

Notes: *Bapalmuia* is the most recent segregate of the collective genus *Bacidia* (SÉRUSIAUX 1993a). From *Bacidia* sensu stricto, it deviates mainly by its ascus type with an I+ darker tubular structure in the tholus (see HAFELLNER 1984). Additional differences are the mostly convex apothecia, the narrower ascospores and the presence of coronatone as major secundary substance, instead of atranorin in *Bacidia* (EKMAN 1996a). *Bapalmuia* is most similar to a number of mainly foliicolous species currently placed in *Bacidia* sensu lato, but belonging to a different genus (LÜCKING & KALB, in prep.). This genus has the same ascus and ascospore type as *Bapalmuia*, but differs in the paraplectenchymatous excipulum and the presence of zeorin as a major component.

The relationships between *Bapalmuia* and *Mycobilimbia* Rehm are also worth consideration. Indeed, both genera share the convex apothecia with a prosoplectenchymatous excipulum and the I+ darker blue tubular structure in the tholus. As circumscribed by HAFELLNER (1989), *Mycobilimbia* consists of two groups, the *M. hypnorum* group and the *M. sabuletorum* group. While the former is probably related to *Clauzadea* Hafellner & Bellem. (PURVIS et al. 1992), the *M. sabuletorum* group appears closer to *Bapalmuia*. However, its species have a different chemistry, typically short ellipsoid ascospores and asci with a tubular structure widening towards the ascus tip. Such asci are also found in the genus *Badimia* Vezda, which is placed in the Pilocarpaceae as well (SÉRUSIAUX 1986; LÜCKING et al. 1994). Thus, although there are certain relationships between *Mycobilimbia* p.p. and the Pilocarpaceae, we are confident about the generic separation between *Bapalmuia* and *Mycobilimbia* sensu HAFELLNER (1989).

Because of its ascus structure and other shared morpho-anatomical similarities with *Fellhanera* p.p. and *Byssoloma* p.p., we place *Bapalmuia* in the Pilocarpaceae, as suggested by SÉRUSIAUX (1993b) and EKMAN (1996a). *Bapalmuia* differs from the other genera in this family by the prosoplectenchymatous excipulum, the needle-shaped ascospores and the chemistry. Due to the presence of free hyphae in the outer part of the excipulum, a few species might be confused with *Byssoloma,* but can be distinguished by the compact, prosoplectenchymatous inner excipulum with labyrinthic structure and the needle-shaped ascospores.

So far, pycnidia are only known from the type species *Bapalmuia palmularis*, *B. nigrescens*, *B. halleana*, and a corticolous collection tentatively assigned to *B. lafayetteana*. In *B. palmularis*, *B. nigrescens*, and *B. halleana*, the conidia are ellipsoid to fusiform, while in the specimen assigned to *B. lafayetteana* they are bifusiform. Besides the excipular structure, conidia are an important feature to characterize genera within the Pilocarpaceae. Since pycnidia are only known from a few species within the genus, we cannot taxonomically evaluate the deviating conidia found in *B.* cf. *lafayetteana*. However, different types of conidia are also found within the genus *Fellhanera*, which otherwise is rather homogeneous (SÉRUSIAUX 1996; LÜCKING 1997).

Distribution and ecology: *Bapalmuia* is present in all (sub)tropical regions and extends with one species (*B. buchananii*) into cool-temperate rainforests of the southern hemisphere. While *B. palmularis* is pantropical, all other species are more or less restricted to either the Neotropics, tropical Africa or Australasia, the Neotropics showing the highest number of taxa.

The species are typical members of cryptogamic communities in the rainforest understory where they grow on bark, bryophytes or living leaves. As far as it can be stated from the material known at present, most species are rather substrate-specific, being either corticolous-muscicolous or foliicolous. While the foliicolous taxa are most common at lower altitudes, the corticolous and muscicolous representatives may occur higher up in the upper montane zone or in temperate rainforests.

Key to the known species of *Bapalmuia*

1a Spores submuriform .... ***Bapalmuia callichroa***
1b Spores transversely septate only **2**

2a Thallus sorediate **3**
2b Thallus without soralia **6**

3a Thallus verrucose or with radiating ridges **4**
3b Thallus smooth **5**

4a Thallus verrucose; ascospores 160-190 × 3.0-3.5 µm, 31-37-septate. – Tropical America .... ***Bapalmuia verrucosa***
4b Thallus with radiating ridges; ascospores 90-130 × 1.5-2.5 µm, 25-35-septate. – Tropical America .... ***Bapalmuia lineata***

5a Ascospores 40-55 × 3.0-3.5 µm, (8-) 12-16-septate – Tropical Australia .... ***Bapalmuia sorediata***
5b Ascospores 80-100 × 2.0-3.0 µm, 15-25-septate – Tropical Asia (Papua New Guinea) .... ***Bapalmuia variratae***

6a Thallus corticolous or muscicolous **7**
6b Thallus foliicolous **11**

7a Apothecia light leather or cinnamon-coloured, pruinose; margin more or less the same colour as the disc, for a long time persistent and apothecial disc rather flat; ascospores 110-150 × 4.5-6 µm, 35-40-septate. – Tropical America .... ***Bapalmuia confusa***
7b Apothecia ochraceous to blackish brown, naked; margin paler than the disc, soon disappearing and then apothecial disc strongly convex; ascospores not broader than 4.5 µm **8**

8a Excipulum with labyrinthic structure and externally with short hairs; ascospores usually less than 3 µm broad **9**
8b Excipulum with radiating cells rows and externally smooth; ascospores usually more than 3 µm broad **10**

9a Ascospores 140-160 × 2.0-2.5 µm, 25-40-septate; thallus smooth. – Tropical Africa .... ***Bapalmuia cacaotica***
9b Ascospores 70-105 × 2.5-3.0 µm, 20-28-septate; thallus smooth to very minutely squamulose and with isidioid outgrowths when old. – Tropical Africa .... ***Bapalmuia halleana***

10a Ascospores 85-150 × 2.5-3.5 µm, 35-50-septate. – Tropical America .... ***Bapalmuia lafayetteana***
10b Ascospores 130-240 × 3.5-4.0 µm, 28-74-septate. – Australasia .... ***Bapalmuia buchananii***

11a Apothecia vertically elongated; ascospores very long (320-510 µm), with very numerous septa (70-100). – Tropical Asia .... ***Bapalmuia marginalis***
11b Apothecia not vertically elongated; ascospores shorter (up to 190 µm), with less septa (up to 39) **12**

12a Ascospores longer than 70 µm and with more than 20 septa **13**
12b Ascospores not exceeding 50 µm and with up to 11 septa **17**

13a Ascospores 160-190 × 2.5-3.5 µm; thallus verrucose, sometimes additionally with soralia; apothecia mostly blackish brown, more rarely reddish brown. – Tropical America .... ***Bapalmuia verrucosa***
13b Ascospores not exceeding 130 × 2.5 µm **14**

14a Thallus with radiating ridges, often additionally with soralia; ascospores 90-130 × 1.5-2.5 µm, 25-35 septate .... ***Bapalmua lineata***
14b Thallus smooth, without soralia **15**

15a Hypothecium light orange brown; excipulum with radiating cell rows and externally with smooth surface; ascospores 70-120 × 1.5-2.5 µm, 25-35 septate. – Pantropical .... ***Bapalmuia palmularis***
15b Hypothecium orange brown to dark reddish brown; excipulum with labyrinthic structure and externally with short hyphae; ascospores 70-105 × 2.0-3.0 µm, 20-30-septate **16**

16a Hypothecium dark reddish brown, K+ purple. – Tropical America .... ***Bapalmuia costaricensis***
16b Hypothecium orange brown, K–. – Tropical Africa .... ***Bapalmuia halleana***
17a Apothecia dark grey to black. – Ascospores 7-9-septate. – Tropical America .... ***Bapalmuia nigrescens***
17b Apothecia orange brown or ochraceous yellow to reddish brown **18**

18a Apothecia vividly orange brown, usually marginally hypophyllous; ascospores 7-11-septate. – Tropical Africa .... ***Bapalmuia ivoriensis***
18b Apothecia ochraceous yellow to reddish brown, usually epiphyllous; ascospores 5-7-septate. – Tropical America .... ***Bapalmuia consanguinea***

The species

Bapalmuia buchananii (Stirt.) Kalb & Lücking comb. nova

Basionym: *Stereocaulon buchananii* Stirt., Trans. Proc. New Zealand Inst. **7:** 367 (1875). – Type: NEW ZEALAND. prope Wellington, 18. IX. 1874, J. Buchanan s.n. (GLAM!, lectotype fide LAMB 1954: 121).

Bacidia pedicellata Knight, Trans. Proc. New Zealand Inst. **12:** 372 (1880). – Type: NEW ZEALAND. S. loc. (prope Wellington), s. dat., C. Knight (WELT, fide GALLOWAY 1985: 29).

Lecidea subglobosa Nyl., Lichenes Novae Zelandiae: 93 (1888). – Type: NEW ZEALAND, s. loc. (prope Wellington), s. dat., C. Knight (H-NYL).

Patellaria wilsonii Müll. Arg., Flora **71:** 541 (1888). – Type: AUSTRALIA.Victoria: Mt. Macedon, Black Spur, s. dat., F. R. M. Wilson (G).

Gomphillus baeomyceoides F. Wilson, J. Linn. Soc. London **28:** 370 (1891). – Type: AUSTRALIA. Victoria: Mt. Macedon, Black Spur, s. dat., F. R. M. Wilson 65 (BM, lectotype).

Bacidia exaltata A. Zahlbr., Denkschr. Akad. Wiss. Wien, Math.-Naturw. Kl. **104:** 319 (1941). – Type: NEW ZEALAND. Hawke's Bay, Mackinnen's Bush near Wairoa, on damp bank, s. dat., E. A. Hodgson (ZA 3550, lectotype; CHR 373615).

Description: Thallus corticolous or muscicolous, smooth to sometimes granular-effuse, grey to greenish grey. Apothecia scattered to rarely confluent, sessile, 0.5-2.0 mm in diam., obconical; disc strongly convex, pale brown to flesh coloured, non-pruinose; margin chamois-coloured, thin, soon disappearing. Excipulum prosoplectenchymatous, with radiating cell rows, c. 150 µm broad; hypothecium centrally 200-350 µm high, colourless to light yellowish brown; epithecium indistinct; hymenium c. 170-350 µm high. Asci cylindrical, 200-250 × 16-20 µm. Ascospores 8 per ascus, in a bundle, 25-75-septate, 130-240 × 3.5-4.0 µm, 40-60 times as long as broad. Pycnidia not observed. Chemistry: 4,5-dichlorolichexanthone (= coronatone).

Notes: This species is very similar to *Bapalmuia lafayetteana*, but differs in the larger ascospores with more numerous septa, and in the Australasian distribution.

Distribution and ecology: As already indicated from the rich synonymy, this lichen is widespread in Australia (Queensland, New South Wales, Australian Capital Territory, Victoria, Tasmania) and New Zealand (North Island, South Island and Stewart Island). It grows on humid bark, partly overgrowing mosses and hepatics in cool-temperate forests.

Additional specimen examined: AUSTRALIA. **AUSTRALIAN CAPITAL TERRITORY**: Tidbinbilla Nature Reserve, c. 40 km SW of Canberra, Cascades Trail, 35° 27' S, 148° 53' E, 1000 m, humid sclerophyll forest with *Eucalyptus fastigiata, Dicksonia antarctica, Acacia* spec., *Olearia* spec. and *Bedfordia* spec., corticolous and muscicolous, 2. VIII. 1992, K. & A. Kalb, J. Curnow, H. Lepp (hb. KALB 32618).

Bapalmuia cacaotica Kalb & Lücking spec. nova

Species nova similis *Bapalmuiae palmularis*, sed differt sporis longioribus et excipulo textura epidermoidea formato. – Type: TANZANIA. **MOROGORO DISTRICT**: Uluguru Mts. above Kiiji cha Tschenzema, muscicolous on mostly rain-protected bases of old tree trunks, 07° 07´ S, 37° 36´ E, 2200-2400 m, 26. IX. 1999, A. Frisch (hb. KALB 32842, holotype).

Description: Thallus muscicolous (and hepaticolous), smooth, greenish grey to greenish. Apothecia scattered, sessile, 0.6-1.0 mm in diam.; disc slightly convex, soon half-globose, chocolate brown to blackish brown, non-pruinose; margin chamois-coloured, distinct, soon disappearing. Excipulum prosoplectenchymatous with labyrinthic structure (textura epidermoidea) and externally with short, free hyphae, colourless, 150 µm broad; hypothecium centrally 100-120 µm high, reddish brown; epithecium indistinct; hymenium c. 220 µm high. Asci cylindrical, 180-220 × 8-10 µm. Ascospores 8 per ascus, in a bundle, 25-40-septate, 140-160 × 2.0-2.5 µm, 65-75 times as long as broad. Pycnidia not observed. Chemistry: 4,5-dichlorolichexanthone (= coronatone).

Notes: This species is easily recognized by its chocolate brown, half-globose apothecia and the long and relatively thin ascospores. From the other non-foliicolous taxa, it is well distinguished by its very narrow ascospores. Its ascospore dimensions make it intermediate between the foliicolous *Bapalmuia palmularis* and *B. verrucosa*; it differs from both by its labyrinthic excipulum and from *B. verrucosa* by its smooth thallus. Morphologically and anatomically very similar is *B. halleana*, but this species has distinctly shorter ascospores.

Distribution and ecology: *Bapalmuia cacaotica* is thus far only known from the type collection from Tanzania in tropical Africa. Its occurrence in a rainforest seems to correspond to the ecology of the other species of the genus, but compared to the bulk of the species, *B. cacaotica* was found at a rather high altitude.

Bapalmuia callichroa (Müll. Arg.) Kalb & Lücking comb. nova

Basionym: *Lopadium callichroum* Müll. Arg., Flora **64:** 532 (1881). – *Lopacidia callichroa* (Müll. Arg.) Kalb, Lich. Neotrop., Fasc. 8, Schedae: 3 (1984). – Type: BRAZIL. **SÃO PAULO:** Prope Apiahy in Brasilia meridionali, Puiggari 1392 (G).

Description: Thallus corticolous or muscicolous, smooth to slightly granulose, pale greenish grey. Apothecia scattered, sessile, 0.7-1.0 mm in diam., obconical; disc slightly convex, light orange brown to greyish brown, often slightly pruinose; margin pale grey to chamois-coloured, soon disappearing. Excipulum prosoplectenchymatous with radiating cell rows, c. 200 µm broad; hypothecium centrally 200-250 µm high, light yellowish brown to orange brown; epithecium indistinct to slightly yellowish brown; hymenium 250-300 µm. Asci cylindrical, 240-280 × 20-30 µm. Ascospores (2-) 4-8 per ascus, in a bundle or parallel arranged, submuriform, with 20-30 transverse and 1-2 longitudinal septa per segment, 100-140 × 7-9 µm, 14-16 times as long as broad. Pycnidia not observed. Chemistry: 4,5-dichlorolichexanthone (= coronatone).

Notes: At first glance, *Bapalmuia callichroa* might be confused with a *Calopadia*, in particular *C. foliicola* (Fée) Vezda. The latter has quite similar apothecia and ascospores, which are slightly broader and occur in a lower number per ascus. However, the anatomical structure of the apothecia (prosoplectenchymatous excipulum, non-aeruginous apothecial base, asci with tubular structure) and the secondary chemistry differ clearly from *Calopadia* and place the species in *Bapalmuia*.

Bapalmuia callichroa demonstrates that even in a group of species with extremely narrow ascospores such as *Bapalmuia*, a transition towards muriform septation is possible.

Distribution and ecology: Thus far, this rare species (neither VAINIO 1890 nor MALME 1937 do report on it) seems to be restricted to the southern, montane parts of the Atlantic rainforest of Brazil, where it overgrows tree bark in the forest understory. It has been found once invaded by the lichenicolous fungus *Dactylospora porphyrea* Hafellner.

Additional specimens examined: BRAZIL. **SÃO PAULO:** Morro Grande near Cotia, c. 25 km W of São Paulo, 23° 41' S, 46° 57' W, 850 m, rainforest, corticolous, 27. IX. 1980, K. Kalb (hb. KALB 14505). Serra do Mar, c. 20 km E of Cruzeiro, 22° 35' S, 44° 45' W, 3. XI. 1978, 1500 m, dark, humid rainforest, corticolous on *Podocarpus* spec., K. Kalb & G. Plöbst (hb. KALB 14507). **RIO DE JANEIRO:** Serra da Mantiqueira, Itatiaia, Parque National do Itatiaia, 22° 20' S, 44° 35' W, 1100 m, dark, humid rainforest, corticolous, 21. VII. 1978, K. Kalb & G. Plöbst (hb. KALB 14506). **MINAS GERAIS:** Serra da Mantiqueira, between Camanducaia and Vila Monte Verde, 22° 45' S, 46° 05' W, 1800 m, corticolous on *Podocarpus* spec., 29. XI. 1980, K. Kalb (KALB: Lich. Neotrop. 184); ibid., 0.5 km W of Vila Monte Verde, c. 30 km E of Camanducaia, 22° 50' S, 46° 00' W, 1500 m, corticolous, 2. VII. 1979, K. Kalb & G. Plöbst (hb. KALB 32821, with the lichenicolous fungus *Dactylospora porphyrea* Haf.).

Bapalmuia confusa Kalb & Lücking spec. nova

Similis *Bapalmuiae lafayetteanae*, sed differt ascosporis crassioribus. – Type: BRAZIL. **SÃO PAULO:** Serra da Cantareira, c. 30 km N of São Paulo, on a deciduous tree, in a dense montane rainforest, 23° 20' S, 46°, 45' W, 950 m, 5. VIII. 1978, K. Kalb & D. Hannack [hb. KALB, holotype; KALB: Lich. Neotrop. 5, isotypes, distributed as *Bacidia multilocularis* (Müll. Arg.) A. Zahlbr.].

Description: Thallus corticolous or muscicolous, smooth to granular-effuse, grey to greenish grey. Apothecia scattered, to rarely confluent, sessile, 0.5-2.0 mm in diam.; disc flat to slightly convex, pale brown to dark greyish brown, with a pale greyish pruina; margin chamois-coloured, distinct, for a long time persistent but in old apothecia disappearing. Excipulum prosoplectenchymatous with labyrinthic structure (textura epidermoidea) and externally with short, free hyphae, 100-120 μm broad; hypothecium centrally 120-130 μm high, light yellowish brown, epithecium light yellowish brown to brown, the outermost layer of the excipulum and the hymenium encrusted with tiny crystals not dissolving in K; hymenium surface with short, free hyphae; hymenium c. 175 μm high. Asci cylindrical, 140-160 × 12-16 μm. Ascospores 8 per ascus, in a bundle, 35-40-septate, 110-150 × 4.5-6.0 μm, 20-25 times as long as broad. Pycnidia not observed. Chemistry: 4,5-dichlorolichexanthone (= coronatone).

Notes: This species is well-characterized by its pruinose apothecia and the broad ascospores. The epithet *confusa* was chosen because this taxon caused quite a lot of confusion. Indeed, it was distributed in the exsiccata series MALME & SANTESSON: Lich. Austro-am. Exs. 238 and KALB: Lich. Neotrop. 5 as *Bacidia multilocularis* (Müll. Arg.) A. Zahlbr. but, as mentioned above, the type of this species belongs to another genus.

Distribution and ecology: *Bapalmuia confusa* exhibits a wide distribution in tropical America. It is a typically corticolous species and is mainly found in the understory of submontane to lower montane rainforests.

Additional specimens examined: VENEZUELA. **YARACUY:** Distr. Bolívar, Sierra de Aroa, Quebrada de Oro, c. 15 km SW of Aroa, 10° 18' N, 69° 00' W, 1500 m, rather original elfin forest, corticolous, 20. VIII. 1989, K. Kalb & R. Smith (hb. KALB 32819). — BRAZIL. **SÃO PAULO:** Serra do Mar, Serra de Boissocanga above Maresias, c. 30 km W of São Sebastião, 23° 45' S, 45° 40' W, 330 m, dark, primary coastal rainforest, corticolous, 18. II. 1980, K. Kalb & G. Plöbst (hb. KALB 14503). Serra do Mar, Serra de Paranapiacaba, c. 60 km SW of São Paulo, above Juquitiba, 23° 50' S, 47° 10' W, 550 m, corticolous on a deciduous tree at the edge of a lake, 27. IV. 1980, K. Kalb & G. Plöbst (hb. KALB 14502); ibid., 700 m, light, humid rainforest along the river Juquiá, corticolous on a deciduous tree, 13. V. 1978, K. Kalb & G. Plöbst (hb. KALB 32625). Morro Grande near Cotia, c. 25 km W of São Paulo, 23° 41' S, 46° 57' W, 850 m, rainforest, corticolous, 27. IX. 1980, K. Kalb (hb. KALB 28215, 32620). **RIO DE JANEIRO:** Corcovado, corticola in silva satis clara, 14.-15. VIII. 1892, G. O. Malme 55, 74 (S); ibid., corticolous, 4. IX. 1892, G. O. Malme (UPS, S; MALME & SANTESSON: Lich. Austro-am. Exs. 238, as *Bacidia multilocularis* (Müll. Arg.) A. Zahlbr.). Serra da Mantiqueira, Itatiaia, Parque National do Itatiaia, 22° 20' S, 44° 35' W, 1100 m, humid, dark primary rainforest, corticolous, 21. VII. 1978, K. Kalb & G. Plöbst (hb. KALB 32622).

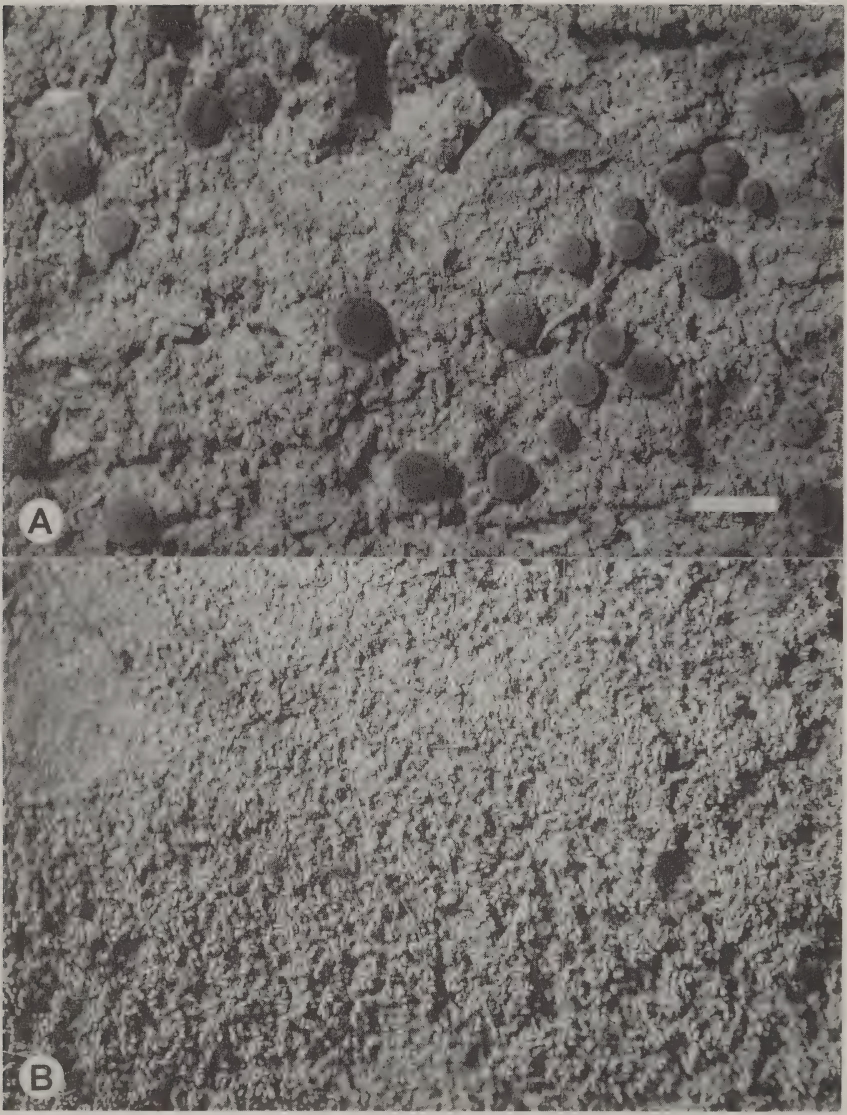

Figure 2: General habit of *Bapalmuia* species. (A) *B. confusa* [Brazil, Malme 55 (S)], thallus with apothecia. Note the thin pruina and thin but persistent margin. (B) *B. confusa* [Brazil, Kalb & Plöbst (hb. KALB 32625)], thallus with isidioid outgrowths. Scale = 1 mm.

Bapalmuia consanguinea (Müll. Arg.) Kalb & Lücking

in LÜCKING & KALB, Bot. Jahrb. Syst. 122 (in press). – Basionym: *Patellaria consanguinea* Müll. Arg., Lichenes Epiphylli Novi: 11 (1890). – *Bacidia consanguinea* (Müll. Arg.) A. Zahlbr., Catal. Lich. Univ. **4:** 188 (1926). — Type: BRAZIL. **SÃO PAULO:** Apiahy, 1882, Puiggari 2288 (G, lectotype!).

Description: Thallus foliicolous, smooth, greenish grey. Apothecia scattered, sessile, 0.4-0.7 mm in diam.; disc strongly convex, ochraceous yellow to brownish red, non-pruinose; margin chamois, very thin, soon disappearing. Excipulum prosoplectenchymatous with radiating cell rows. Hypothecium centrally 60-80 µm high, yellowish brown; epithecium indistinct; hymenium c. 70-100 µm high. Asci narrowly clavate, 50-70 × 6-10 µm. Ascospores 8 per ascus, in a bundle, 5-7-septate, 30-50 × 1.5-2.5 µm, 18-23 times as long as broad. Pycnidia not observed. Chemistry: not studied.

Notes: The relatively short ascospores with few septa and the ochraceous yellow to brownish red apothecia are distinctive for this species. The likewise neotropical *Bapalmuia nigrescens* has similar ascospores, but differs by the blackish apothecia. *B. ivoriensis*, only known from Africa, is in many respects similar but differs in the more orange apothecia with a byssoid outer excipulum. In addition, its ascospores have more numerous septa.

Distribution and ecology: Neotropical, thus far only known from the southern part of the Atlantic rainforest in Brazil. The species is a typical member of the lichen community of the rainforest understory.

Additional specimens examined: BRAZIL. **MINAS GERAIS:** Serra do Espinhaço, Serra do Caraça, 1400 m, foliicolous, 1885, Vainio 1440b (TUR-Vainio 20782 as *Lecidea endoporphyrea*); ibid., Bocaina, c. 4 km E of the monastery, 20° 10' S, 43° 30' W, 1450 m, foliicolous, 25. V. 1978, K. Kalb & G. Plöbst (hb. KALB 32735). **RIO DE JANEIRO:** Rio de Janeiro, foliicolous, 1889, Glaziou 18012 (G). Serra da Mantiqueira, Itatiaia, Parque National do Itatiaia, 22° 20' S, 44° 35' W, 1100 m, humid, dark primary rainforest, foliicolous, 21. VII. 1978, K. Kalb & G. Plöbst (hb. KALB 32736). **SÃO PAULO:** Apiahy, foliicolous, 1882, Puiggari 2288 (G). Serra do Mar, Serra Bananal, c. 100 km SW of São Paulo, 24° 10' S, 47° 05' W, 200 m, dark, humid rainforest, foliicolous, 23. III. 1978, K. Kalb & G. Plöbst (hb. KALB 32715). Serra do Mar, Serra do Garrãozinho, between Mogi das Cruzes and Bertioga, 23° 45' S, 46° 10' W, 300-600 m, original rainforest, foliicolous, 6. IX. 1980, K. Kalb (hb. KALB 32716).

Bapalmuia costaricensis Lücking & Kalb spec. nova

Bacidia costaricensis nom. nud. in LÜCKING, Nova Hedwigia Beih. **104:** 130 (1992). – Haec species imprimis apotheciis usque ad 1.0 mm latis et margine persistente et hypothecio rubrofusco K+ purpureo ab speciebus aliis generis *Bapalmuia* differt. – Type: COSTA RICA. **PUNTARENAS:** Carara Biological Reserve, 55 km WSW of San José near the Pacific coast, 9° 47' N, 84° 35' W, 50-100 m, lowland evergreen moist forest, on leaves of *Erythrochiton gymnanthus* (Rutaceae), IX. 1991, Lücking 91-1835 (CR, holotype).

Description: Thallus foliicolous, sometimes covering the whole leaf surface, smooth but usually cracked when well-developed, pale greenish grey. Apothecia scattered, usually epiphyllous on the thallus sur-

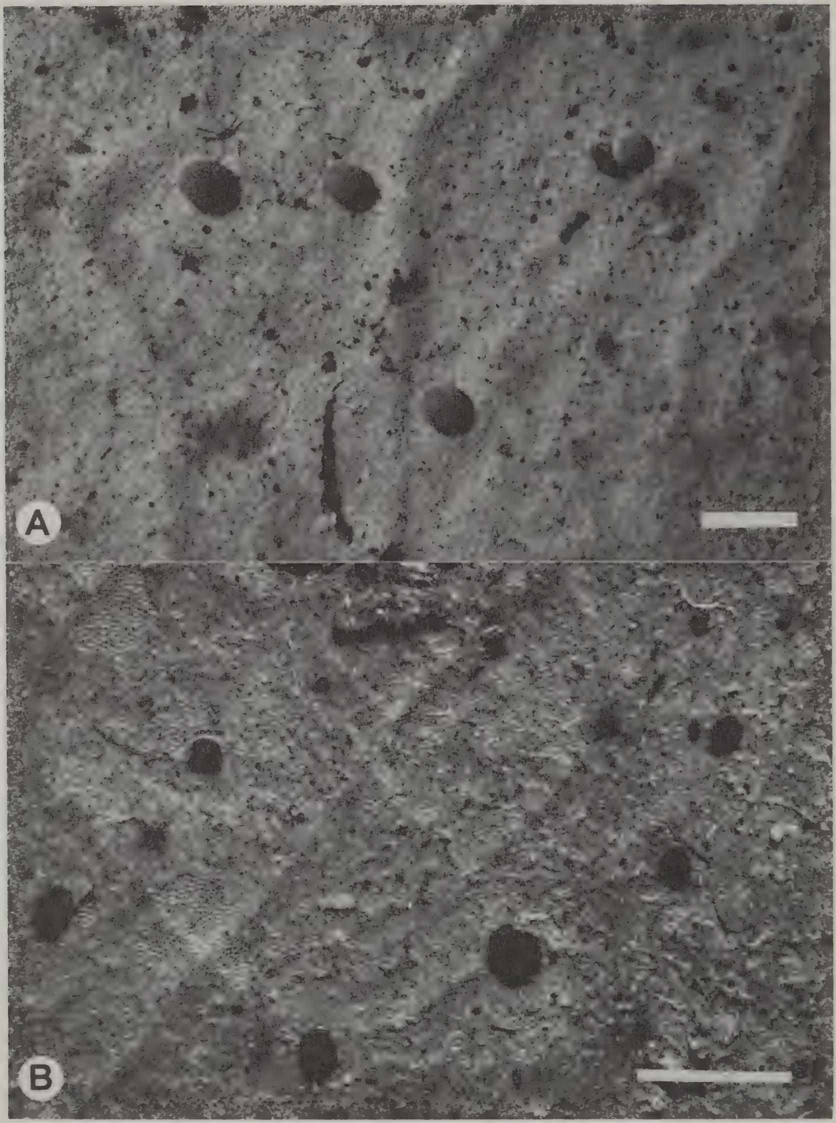

Figure 3: General habit of *Bapalmuia* species. (A) *B. consanguinea* [Brazil, Kalb & Plöbst (hb. KALB 32716], thallus with apothecia. (B) *B. nigrescens* [Brazil, holotype], thallus with apothecia. Scale = 1 mm.

face, rarely marginally hypophyllous on a mycelium free of algae, sessile, rounded to slightly irregular in outline when old, 0.7-1.0 mm in diam.; disc flat to slightly convex when old, blackish brown to almost black, non-pruinose; margin rather thick (0.05-0.15 mm), persistent even in mature apothecia, chamois-coloured to whitish, basally slightly byssoid and sometimes forming a root-like mycelium in young apothecia. Excipulum well-developed, prosoplectenchymatous with labyrinthic structure, up to 50 µm thick, pale yellowish brown, on the outer edge, especially in young apothecia, with a 30-50 µm thick tissue of loosely interwooven, byssoid hyphae, separated from the inner excipulum by a darker zone; hypothecium centrally up to 80 µm high, dark reddish brown, K+ purple; epithecium indistinct; hymenium 100-120 µm high. Asci narrowly cylindrical, 70-100 × 4-6 µm. Ascospores 8 per ascus, in a bundle, 20-30-septate, 70-90 × 2.5-3.5 µm, 20-30 times as long as broad. Pycnidia not observed. Chemistry: no substances dedected by TLC.

Notes: This new species is readily identified by its comparatively large apothecia with slightly convex disc and persistent, thick margin. In most other species of *Bapalmuia*, the apothecia usually are strongly convex and emarginate when mature. Anatomical details further characterize *B. costaricensis*: the small-celled excipulum with labyrinthic structure and byssoid outer part, and the dark, K+ purple hymenium. Based on these characters, the species seems to be related to *B. confusa*, which differs by the much larger and broader ascospores and the pruinose apothecia, and to *B. cacaotica* and *B. halleana*, which have lighter apothecia with paler, K– hypothecium and, in the case of the former, much longer ascospores.

Distribution and ecology: *Bapalmuia costaricensis* has been found on leaves in various parts of the Neotropics. Like *B. palmularis* and *B. lineata, B. costaricensis* seems to be a typical representative of foliicolous lichen communities in the shady understory of tropical lowland rainforests.

Additional specimens examined: COSTA RICA. **PUNTARENAS**: Carara Biological Reserve, 55 km WSW of San José near the Pacific coast, 9° 47' N, 84° 35' W, 50-100 m, lowland evergreen moist forest, foliicolous on *Erythrochiton gymnanthus* (Rutaceae), VIII. 1987, R. Lücking 87-353 (hb. LÜCKING). **HEREDIA**: La Selva Biological Station, 60 km N of San José, 10° 26' N, 84° 03' W, 50 m, lowland rainforest, foliicolous on undetermined dicotyledon, IX. 1991, R. Lücking 91-1955 (hb. LÜCKING). — ECUADOR. **NAPO**: Jatun Satcha Biological Station, 25 km E of Tena at Río Napo, 1° 04' S, 77° 35' W, 450 m, lowland to submontane rainforest, foliicolous, V. 1996, R. Lücking 96-576 (hb. LÜCKING).

Bapalmuia halleana Sérus. spec. nova

Similis *Bapalmuiae cacaoticae*, sed differt ascosporis minoribus. – Type: GABON. Forêt des Abeilles, Station Forestière de la Makande, 0° 49' S, 11° 54' W, 300 m, forêt ombrophile, foliicole, II. 1999, Sérusiaux s.n. (LG, holotype).

Description: Thallus corticolous or foliicolous, smooth to minutely very squamulose-araneous and with irregular isidioid outgrowths when old, pale green to greyish green. Apothecia scattered to abundant, when foliicolous often marginally hypophyllous on a mycelium free of algae, sessile, rounded, 0.5-0.8 mm in diam.; disc strongly convex when old, chocolate brown to dark brown, non-pruinose; margin rather thick (0.05-0.1 mm), persistent but much thinner and not prominent in mature apothecia, chamois-coloured to whitish, basally slightly byssoid and sometimes forming a root-like mycelium in young apothecia. Excipulum well-developed, prosoplectenchymatous with labyrinthic structure, up to 80 µm thick, pale yellowish brown, on the outer edge, especially in young apothecia, with short, free hyphae; hypothecium centrally up to 180 µm high, orange brown; epithecium indistinct; hymenium 120-150 µm high. Asci narrowly cylindrical, 110-140 × 8-10 µm. Ascospores 8 per ascus, in a bundle, 20-30-septate, 70-105 × 2.5-3.0 µm, 25-35 times as long as broad. Pycnidia abundant in foliicolous specimens, pale flesh coloured, hemispherical to wart-shaped, often with a crater-like (sometimes black) ostiolum, conidia fusiform, 4-5 × 1-1.5 µm. Chemistry: not studied in material from Gabon, but 4,5-dichlorolichexanthone (= coronatone) confirmed by HPTLC in the specimens cited from Tanzania.

Notes: *Bapalmuia halleana* is dedicated to Prof. F. Hallé, the organizer and leader of the mission 'Le Radeau des cimes' organized in Gabon to explore the tree canopies in the African lowland rainforest.

This new species is most similar to *Bapalmuia cacaotica*, from which it differs by its shorter ascospores, and to *B. costaricensis*, which has darker apothecia with thicker margin and a darker, K+ purple hypothecium. In the corticolous collections from the type locality, the thallus is provided by dense, irregular isidioid outgrowths, a feature also observed in e.g. *B. confusa* and *B. lafayetteana*. The foliicolous specimens of *B. halleana* have a smooth thallus usually featuring abundant pycnidia, but the apothecial anatomy is essentially the same.

Distribution and ecology: *Bapalmuia halleana* is known from the type locality and from a number of foliicolous collections from Tanzania. In the lowland rainforest in Gabon, the species was quite abundant on bark in the shady understory, while it was absent from the canopy and marginal parts of the forest.

Additional specimens examined: TANZANIA. **IRINGA REGION:** Udzungwa Mts., rainforest near Itonya Village, 1500-1600 m, 08° 12' S, 36° 00' E, 12. IX. 1999, D. Schwenk (hb. KALB 32863, 32864, 32865, 32868) – **dto:** Udzungwa Mts., rainforest between Kiwalamo and Idunda Villages, 1700-1800 m, 08° 08' S, 26° 03' E, 13. IX. 1999, D. Schwenk (hb. KALB 32862, 32869); - **MOROGORO REGION:** Kilombero District, Udzungwa Mts., Luhega Forest Reserve, 1300-1400 m, 08° 24' S, 35° 59' E, 16. IX. 1999, D. Schwenk (hb. KALB 32866, 32867).

Bapalmuia ivoriensis R. Sant. & Lücking

Nord. J. Bot. (in press). – Type: IVORY COAST. **MAN:** Forest of Kouin, 30 km E of Man, 300-400 m, tropical lowland moist forest, foliicolous, VIII. 1954, R. Santesson 10668:7 (UPS, holotype!).

Description: Thallus foliicolous, smooth, pale green, whitish prothallus usually present. Apothecia usually marginally hypophyllous on a mycelium free of algae, regularly rounded, 0.3-0.9 mm in diam.; disc strongly convex, vividly orange brown, non-pruinose; margin thin, whitish, with byssoid outer parts, soon disappearing. Excipulum prosoplectenchymatous with radiating hyphae and byssoid outer parts; hypothecium centrally 70 µm high, light yellowish brown; epithecium indistinct; hymenium 50-60 µm high. Asci narrowly clavate, 45-55 × 6-9 µm. Ascospores 8 per ascus, in a bundle, 7-11-septate, 30-35 × 1.5-2.0 µm, 15-20 times as long as broad. Pycnidia not observed. Chemistry: no substances detected by TLC.

Notes: This recently discovered species is well-distinguished by its strongly convex, vividly orange brown apothecia with partly byssoid margin and comparatively short ascospores. *Bapalmuia nigrescens* is anatomically similar but differs by its grey to black apothecia. *B. ivoriensis* might be confused with the neotropical *B. consanguinea*, but that species has usually epiphyllous apothecia and larger ascospores with less numerous septa, and the apothecial margin is completely smooth. Also similar in apothecial colour is *Bacidia dimerelloides* Vezda which can be separated by the flat apothecial disc and the paraplectenchymatous excipulum.

With its partly byssoid excipulum and rather short ascospores, *Bapalmuia ivoriensis* takes a somewhat intermediate position between *Bapalmuia* and *Byssoloma*, thus indirectly confirming the placement of *Bapalmuia* in the Pilocarpaceae and the close relationship between both genera. We keep the species in *Bapalmuia* because of the prosoplectenchymatous inner exciple and the narrow ascospores.

Specimens resembling *Bapalmuia ivoriensis* have been distributed in VEZDA: Lich. Sel. Exs. 2031 from Tanzania, as *Bapalmuia palmularis*. They have somewhat shorter and broader ascospores (20-30 × 2.0-2.5 µm) with only 3-7 septa, but the material is too scanty to decide whether it represents a new species.

Distribution and ecology: *Bapalmuia ivoriensis* is thus far only known from two collections from the Ivory Coast and Tanzania in tropical Africa. Its ecology seems to correspond to that of the other foliicolous species of the genus.

Additional specimen examined: TANZANIA. **TANGA REGION:** SE corner of Mazumbai University Forest Reserve, submontane rainforest, foliicolous, 24. II. 1982, 1500 m, T. Pócs 6962 (hb. KALB 17196).

Bapalmuia lafayetteana (Vain.) Kalb & Lücking comb. nova

Basionym: *Bacidia lafayetteana* Vain., Acta Soc. Fauna Fl. Fenn. **7**: 14 (1890). – Type: BRAZIL. **MINAS GERAIS:** Lafayette, 1885, E. A. Vainio (TUR-Vain. 20800, lectotype!, selected here; VAINIO: Lich. Bras. Exs. 295).

Description: Thallus corticolous or muscicolous, smooth to granular-effuse, grey to greenish grey. Apothecia obconical, scattered, to rarely confluent, sessile, 0.6-1.4 mm in diam.; disc convex, light orange brown to dark brown, non-pruinose; margin chamois-coloured, thin, soon disappearing. Excipulum prosoplectenchymatous with radiating cell rows, 70-130 µm broad; hypothecium centrally 250 µm high, light yellowish brown; epithecium indistinct to light yellowish brown; hymenium c. 120-200 µm high. Asci narrowly cylindrical, 110-180 × 12-15 µm. Ascospores 8 per ascus, in a bundle, 35-50-septate, 85-130 × 2.5-3.5 µm, 30-40 times as long as broad. Pycnidia not observed (in genuine specimens; but see below!). Chemistry: 4,5-dichlorolichexanthone (= coronatone; e. g. in the type!) or no substances detected by TLC.

Notes: VAINIO (1890: 14) spelled the epithet "*lafayettiana*", but in the same paper corrected it (loc. cit.: 256) to "*lafayetteana*".

This species is distinguished from the likewise neotropical *Bapalmuia confusa* by the narrower ascospores and non-pruinose apothecia and from the australasian *B. buchananii* mainly by the smaller ascospores. *B. lafayetteana* is rather similar and perhaps closely related to the foliicolous type species, *B. palmularis*, which has smaller apothecia and narrower ascospores with more numerous septa.

As circumscribed here, the species seems to be heterogeneous with regard to secondary chemistry and anatomical details. The two collections marked with an asterix (*) below are identical with the type regarding the chemistry, but differ in the flat apothecia with persistent margin, while the other collections have typically emarginate apothecia but lack secondary substances. A further collection [hb. KALB 32621] was tentatively assigned to *B. lafayetteana*, however it carries pycnidia which produce bifusiform conidia and hence differs in this cha-racter from the type species of the genus.

Distribution and ecology: The species is thus far only known from the north- and south-eastern parts of Brazil (Atlantic rainforest).

Additional specimens examined: BRAZIL. **BAHIA:** Chapada Diamantina, Serra do Tombator, between Mundo Novo and Morro de Chapeú, 11° 50' S, 40° 45' W, 800 m, dark rainforest, corticolous, 20. VII. 1980, K. Kalb & M. Marcelli (hb. KALB 15118, 32621*); ibid., c. 10 km N of Rui Borbosa, 12° 10' S, 40° 25' W, 400 m, dark rainforest, corticolous, 18. VII. 1980, K. Kalb & M. Marcelli (hb. KALB 15117*). **SÃO PAULO:** Serra do Mar, Serra do Garrãozinho, between Mogi das Cruzes and Bertioga, 23° 45' S, 46° 10' W, 850 m, primary rainforest, corticolous, 29. III. 1980, K. Kalb (hb. KALB 32624); ibid., corticolous, 28. X. 1978 (hb. KALB 32619). Serra do Mar, between Taubaté and Ubatuba, c. 150 km E of São Paulo, 23° 15' S, 45° 15' W, 800 m, dense, humid rainforest, corticolous, 18. VI. 1978, K. Kalb & G. Plöbst (hb. KALB 32626).

Bapalmuia lineata Lücking & Kalb spec. nova

Species nova imprimis thallo verrucis elongatis radiantis instructis perspicua; apothecia apotheciorum *Bapalmuiae palmularis* similes; ascosporae 25-35-septatae usque ad 130 µm longae. – Type: COSTA RICA. **LIMÓN**: Hitoy Cerere Biological Reserve, 120 km ESE of San José near the Atlantic coast, 9° 41' N, 83° 02' W, 100-200 m, lowland rainforest, foliicolous on *Cryosophila warscewizcii* (Arecaceae), III. 1991, R. Lücking 91-1266 (CR, holotype).

Description: Thallus foliicolous, sometimes covering large areas of the leaf, provided with distinct elongate ridges which radiate from the basis of the apothecia or are irregularly arranged; ridges 0.05 mm thick, near apothecia thicker and root-like, chamois-coloured, thallus otherwise pale greenish grey. Rounded to irregular maculate soralia sometimes present, 0.3-1.0 mm broad, partly confluent, with pale greenish contents. Apothecia scattered, usually marginally hypophyllous on a mycelium free of algae, rarely epiphyllous on the thallus surface, sessile, regularly rounded, 0.5-0.8 (-1.1) mm in diam.; disc orange to dark reddish brown, strongly convex when old, non-pruinose; margin thin, in mature apothecia disappearing, chamois-coloured to whitish, basally forming a root-like mycelium in young apothecia. Excipulum well-developed, prosoplectenchymatous with radiating cell rows, up to 100 µm thick, yellowish grey with darker grey marginal zone; hypothecium centrally up to 150 µm high, pale orange yellow; epithecium not developed; hymenium 140-170 µm high. Asci narrowly cylindrical, 110-150 × 4-6 µm. Ascospores 8 per ascus, in a bundle, 25-35-septate, 90-130 × 1.5-2.5 µm, 50-60 times as long as broad. Pycnidia not observed. Chemistry: 4,5-dichlorolichexanthone (= coronatone).

Notes: *Bapalmuia lineata* is easily recognized by the elongate, usually radiating ridges on the thallus which are somewhat reminescent of those of *Mazosia rotula* but less regular and of a different structure. The apothecia are morphologically and anatomically very similar to those of *B. palmularis*, indicating a close relationship with that species which differs, however, by the smooth thallus.

Bapalmuia lineata is sometimes attacked by the lichenicolous fungus *Pyrenidium santessonii* Lücking (LÜCKING 1998), which seems to be restricted to species hitherto assigned to *Bacidia* sensu lato but actually belonging to the Pilocarpaceae.

Distribution and ecology: *Bapalmuia lineata* is widely distributed in the Neotropics. It shares the same ecological preferences as *B. palmularis*, being abundant on leaves in the shady understory of tropical lowland rainforests. Both species are often found side by side on the same leaves and can be considered sympatrical taxa.

Additional specimens examined: COSTA RICA. **HEREDIA:** La Selva Biological Station, 60 km N of San José, 10° 26' N, 84° 03' W, 50 m, lowland rainforest, foliicolous, VII. 1997, R. Lücking 97-1561 (hb. LÜCKING). **LIMÓN:** Hitoy Cerere Biological Reserve, 120 km ESE of San José near the Atlantic coast, 9° 41' N, 83° 02' W, 100-200 m, lowland rainforest, foliicolous on undetermined dicotyledon, III. 1991, R. Lücking 91-1266 (hb. LÜCKING; with the lichenicolous fungus *Pyrenidium santessonii*). — GUYANA. **POTARO/SIPARUNI:** Paramakatoi village, 4° 42' N, 59° 43' W, 500-800 m, tropical submontane moist forest, foliicolous, II. 1996, R. Lücking 96-3760 (BRG). — ECUADOR. **NAPO:** Jatun Satcha Biological Station, 25 km E of Tena at Río Napo, 1° 04' S, 77° 35' W, 450 m, lowland to submontane rainforest, foliicolous, V. 1996, R. Lücking 96-505 (QCA), 96-800 (QCNE). — BRAZIL. **PARÁ:** Near Belém, 1° 00' S, 49° 00' W, 10 m, lowland rain forest, foliicolous, 19.-20. X. 1980, K. Kalb (hb. KALB 32724).

Bapalmuia marginalis (Vain.) Sérus.

Nord. J. Bot. **13:** 451 (1993). – Basionym: *Helotiopsis marginalis* Vain., Ann. Acad. Sci. Fenn., ser. A, 15: 151 (1921). – Type: PHILIPPINES. **POLILLO:** S. loc., foliicolous, 1909, Robinson s. n. (TUR-Vainio 26083, holotype!).

Description: Thallus foliicolous, smooth, pale greenish green. Apothecia marginally hypophyllous on a mycelium free of algae, rounded, 0.3-0.5 mm in diam., vertically strongly elongate and up to 1.1 mm high; disc slightly convex, reddish brown, non-pruinose; margin thin, chamois-coloured to reddish white, basally forming a root-like mycelium in young apothecia. Excipulum prosoplectenchymatous with radiating cell rows, 50-70 µm broad; hypothecium centrally 30-70 µm high, brown; epithecium indistinct; hymenium 400-550 µm high. Asci narrowly cylindrical, 350-520 × 6-8 µm. Ascospores (6-)8 per ascus, in a bundle, 70-100-septate, 320-510 × 2.0-2.5 µm, 150-200 times as long as broad. Pycnidia not observed. Chemistry: not studied.

Notes: *Bapalmuia marginalis* is a very conspicuous species due to the vertically elongate apothecia with very long ascospores. The apothecia seem to be stipitate by superficial examination but are completely filled by the hymenium.

Distribution and ecology: The species is only known from a few collections from tropical Asia.

Additional specimens examined: INDONESIA. **SUMATRA:** Oostkust, near Besitang, 30 m, foliicolous, s. dat., Palm 61b (UPS). PAPUA NEW GUINEA. **MADANG:** Burbura logging site, 35 km NNW of Madang, 4° 48' S, 145° 38' E, 50 m, virgin rainforest on low hills, foliicolous, 28. VII. 1992, Sérusiaux 13500-4 (LG).

Bapalmuia nigrescens (Müll. Arg.) Cáceres & Lücking

Nova Hedwigia (in press). – Basionym: *Patellaria nigrescens* Müll. Arg., Lichenes Epiphylli Novi: 11 (1890). – *Bacidia nigrescens* (Müll. Arg.) Vain., Ann. Acad. Sci. Fenn., ser. A, **15:** 66 (1921). – Type: BRAZIL. **RIO DE JANEIRO:** Rio de Janeiro, foliicolous, 1889, Glaziou 18100 (G, lectotype!).

Description: Thallus foliicolous, smooth, greenish grey to olive grey. Apothecia scattered, either epiphyllous or marginally hypophyllous on a mycelium free of algae, sessile, 0.3-0.6 mm in diam.; disc strongly convex, in epiphyllous apothecia greyish black to black, in marginally hypophyllous apothecia greyish brown, non-pruinose; margin white to dark grey, very thin, soon disappearing. Excipulum prosoplectenchymatous with radiating cell rows and thinly byssoid outermost parts, 25-50 µm broad; hypothecium centrally 50-60 µm high, blackish brown; epithecium indistinct; hymenium 50-70 µm high. Asci narrowly clavate, 50-60 × 6-10 µm. Ascospores 8 per ascus, in a bundle, 7-9-septate, 25-40 × 2.0-2.5 µm, 12-16 times as long as broad. Pycnidia hemispherical to wart-shaped, 0.1 mm in diam. Conidia narrowly ellipsoid, unseptate, 5 × 1 µm. Chemistry: no substances detected by TLC.

Notes: *Bapalmuia nigrescens* is anatomically similar to *B. consanguinea* but differs clearly from this and other species of the genus by the greyish black to black apothecia with no brown tinge (CÁCERES & LÜCKING 2000).

Distribution and ecology: Widely neotropical but uncommon and thus far only known from a few scattered localities. The species usually grows together with other species of *Bapalmuia* and representatives of *Byssolecania* in the understory of lowland rain forests.

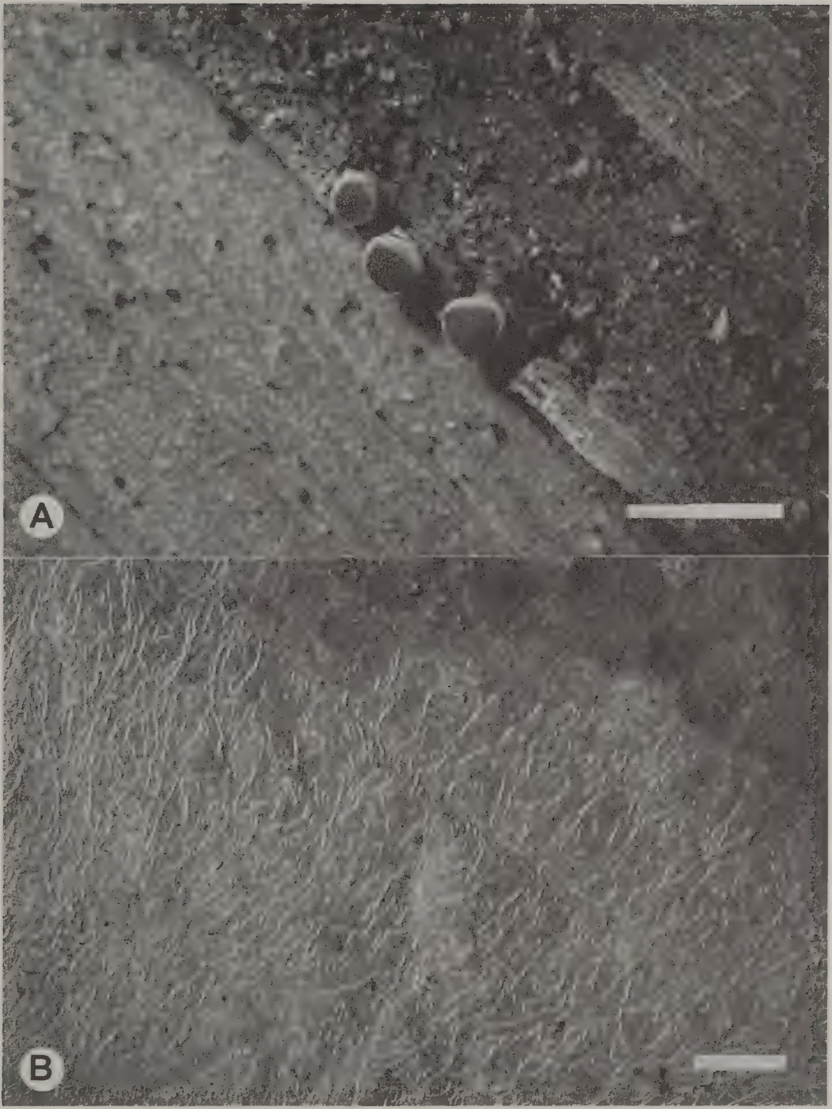

Figure 4: General habit of *Bapalmuia* species. (A) *B. lineata* [Costa Rica, Lücking 91-5629 (hb. LÜCKING)], marginally hypophyllous, young apothecia. Note the distinct margin. (B) *B. lineata* [Costa Rica, Lücking 91-1266a (hb. LÜCKING)], thallus with radiate ridges. Scale = 1 mm.

Additional specimens examined: COSTA RICA. **HEREDIA:** La Selva Biological Station, 60 km N of San José, 10° 26' N, 84° 03' W, 50 m, tropical lowland rainforest, foliicolous on undetermined dicotyledon, VII. 1997, R. Lücking 97-327, 97-1622, 97-1560 (hb. LÜCKING). BRAZIL. **PERNAMBUCO:** Gurjaú Ecological Reserve, near Cabo, 8° 16' S, 35° 02' W, 50-100 m, tropical evergreen dry forest, foliicolous, VIII-XI. 1997, M. Cáceres 97-41 (URM). Açude do Prata Forest Reserve (Dois Irmãos), 8° 00' S, 34° 57' W, 50-100 m, tropical evergreen dry forest, foliicolous, IV. 1989, W. A. Cavalcante & A. A. Silva 43205 (URM 75478); ibid., II. 1998, M. Cáceres & R. Lücking 98-138 (URM). **MINAS GERAIS:** Serra do Espinhaço, Serra do Caraça, 1400 m, foliicolous, IX. 1997, Cáceres s. n. (hb. CÁCERES). **SÃO PAULO:** Apiahy, foliicolous, s. dat., Puiggari 1086 (G).

Bapalmuia palmularis **(Müll. Arg.) Sérus.**

Nord. J. Bot. **13:** 451 (1993). – Basionym: *Patellaria palmularis* Müll. Arg., Lichenes Epiphylli Novi: 10 (1890). – *Bacidia palmularis* (Müll. Arg.) A. Zahlbr., Catal. Lich. Univ. **4:** 231 (1926). – Type: BRAZIL. **RIO DE JANEIRO:** Rio de Janeiro, 1889, Glaziou 18069 (G, holotype!).

Patellaria brasiliensis var. *laevis* Müll. Arg., Lichenes Epiphylli Novi: 10 (1890). – Type: BRAZIL. **SÃO PAULO:** Apiahy, s. dat., Puiggari 1086b (G, holotype!).

Patellaria rubicunda Müll. Arg., Lichenes Epiphylli Novi: 10 (1890). – *Bacidia rubicunda* (Müll. Arg.) A. Zahlbr., Catal. Lich. Univ. **4:** 239 (1926). – *Bapalmuia rubicunda* (Müll. Arg.) Sérus., Nord. J. Bot. **13:** 451 (1993). – Type: BRAZIL. **São Paulo:** Apiahy, s. dat., Puiggari 1086 (G, holotype!).

Bacidia lutea nom. nud. in LÜCKING, Nova Hedwigia Beih. **104:** 130 (1992).

Description: Thallus foliicolous, smooth, pale greenish green. Apothecia usually marginally hypophyllous, more rarely epiphyllous on a mycelium free of algae, regularly rounded, 0.4-1.0 mm in diam.; disc strongly convex, orange to reddish brown in young and epiphyllous apothecia and dark reddish to blackish brown in old and marginally hypophyllous apothecia; margin thin, chamois-coloured to whitish, soon disappearing, basally forming a root-like mycelium in young apothecia. Excipulum prosoplectenchymatous with radiating cell rows, 50-80 μm broad; hypothecium centrally 150 μm high, brown; epithecium indistinct; hymenium 120-150 μm high. Asci narrowly cylindrical, 100-140 × 6-10 μm. Ascospores (6-)8 per ascus, in a bundle, 25-35-septate, 70-120 × 1.5-2.5 μm, 45-50 times as long as broad. Pycnidia common on the thallus surface, hemispherical, 0.1-0.15 mm in diam. Conidia fusiform, unseptate, 4-6 × 1.0-1.5 μm. Chemistry: 4,5-dichlorolichexanthone (= coronatone).

Notes: *Bapalmuia palmularis* is characterized by the combination of smooth thallus, usually marginally hypophyllous apothecia and rather long, thin ascospores. The anatomically similar and also foliicolous *B. lineata* and *B. verrucosa* are easily separated by their different thallus structure. Among the non-foliicolous taxa, the most similar species is *B. lafayetteana*, which differs in the larger apothecia and the somewhat broader ascospores.

The colour of the apothecial disc in *Bapalmuia palmularis* varies from orange to blackish brown, depending on the age and position of the apothecia. Specimens with light apothecia are represented by the type material of *Patellaria rubicunda* (MÜLLER ARG. 1890) and by the invalidly published name *Bacidia lutea* (LÜCKING 1992).

Distribution and ecology: A common, pantropical species. *Bapalmuia palmularis* is a characteristic species of foliicolous lichen communities in the shady understory of tropical rainforests and usually accompanied by large species of the genera *Bapalmuia*, *Byssolecania* [*B. fumosonigricans* (Müll. Arg.) R. Sant., *B. hymenocarpa* (Vain.) Kalb, Vezda & Lücking), *B. deplanata* (Müll. Arg.) R. Sant. and *B. variabilis* Vezda, Kalb & Lücking], *Dimerella* (regarded a synonym of *Coenogonium*, see LÜCKING & KALB 2000) [*D. siquirrensis* Lücking] and *Porina* [*P. imitatrix* Müll. Arg., *P. distans* Vezda & Vivant coll.].

Selected specimens examined: COSTA RICA. **HEREDIA:** La Selva Biological Station, 60 km N of San José, 10° 26' N, 84° 03' W, 50 m, lowland rainforest, foliicolous, IX. 1991, R. Lücking 91-2459 (hb. KALB). **LIMÓN:** Hitoy Cerere Biological Reserve, 120 km ESE of San José near the Atlantic coast, 9° 41' N, 83° 02' W, 100-200 m, lowland rainforest, foliicolous on palm, III. 1991, R. Lücking 91-1265 (hb. KALB). — GUYANA. **POTARO/SIPARUNI:** Paramakatoi village, trail NW to Kato, 4° 42' N, 59° 43' W, 500-800 m, lowland to submontane moist forest, foliicolous, II. 1996, R. Lücking 96-3761 (BRG, US). — ECUADOR. Napo: Jatun Satcha Biological Station, 25 km E of Tena, 1° 04' S, 77° 35' W, 450 m, lowland to submontane rainforest, foliicolous, V. 1996, R. Lücking 96-574 (hb. LÜCKING). — BRAZIL. **AMAZONAS:** "Terra sujo" of Rio Preto, shortly before the mouth into the Amazon, c. 80 km E of Manaus, 03° 10' S, 59° 50' W, 40 m, foliicolous, VIII. 1993, K. & A. Kalb 27136 (hb. KALB). **SÃO PAULO:** Apiahy, s. dat., Puiggari 1086, 1086 b (G). Ilha de São Sebastião, c. 130 km SW of São Paulo, western slope of Morro das Tacas, 23° 50' S, 45° 20' W, 600 m, IV. 1978, very humid rainforest, foliicolous, K. Kalb & G. Plöbst 32720 (hb. KALB). Serra do Mar, Serra do Garrãozinho, between Mogi das Cruzes and Bertioga, 23° 45' S, 46° 10' W, 300-600 m, primary rainforest, foliicolous, IX. 1980, K. Kalb 32719, 32722 (hb. KALB). Morro Grande near Cotia, c. 25 km W of São Paulo, 23° 41' S, 46° 57' W, 850 m, rainforest, foliicolous, IX. 1980, K. Kalb 32725 (hb. KALB).

IVORY COAST. Taï National Park. 5° 52' N, 7° 27' W, 200 m, tropical lowland moist forest, foliicolous, 1992, U. Becker (KOELN). — GABON. Forêt des Abeilles, Station Forestière de la Makande, 0° 49' S, 11° 54' W, 300 m, forêt ombrophile, foliicole, II. 1999, Sérusiaux s.n. (LG). — DEMOCRATIC REPUBLIC OF CONGO (formerly Zaïre). **HAUT-ZAÏRE:** Prope staionem 87 km signatam viae a Kisangani ad Bafwasende ducentis, 300 m, foliicola in sylva primaria, S. Lisowski 43172 (hb. KALB; VEZDA: Lich. Sel. Exs. 1484). **KIVU:** Irangí, Réserve de l'IRSAC, 850 m, foliicole, I. 1972, Lambinon 72/18 (LG). **BAS-CONGO:** Leopoldville, Idiofa, Ipamu, foliicolous, 1921, Vanderyst 10554 (UPS). — TANZANIA. Usambara Mts., Amani, 800 m, foliicolous, 1909, Brunnthaler s. n. (UPS).

PAPUA NEW GUINEA. **MOROBE:** Boana, 1200 m, foliicolous, 1940, M. Clemens s. n. (UPS).

AUSTRALIA. **QUEENSLAND:** Eacham Shire, Souita Falls, 8 km SE of Millaa Millaa, 17° 35' S, 145° 40' E, tropical rainforest, foliicolous, VIII. 1987, A. Henssen 31250 (hb. HENSSEN).

Bapalmuia sorediata Kalb & Lücking spec. nova

Species nova similis *Bapalmuiae palmularis*, sed differt ascosporis minoribus (40-55 × 3.0-3.5 μm), (8-) 12-16-septatis et imprimis thallo soredioso. – Type: AUSTRALIA. **QUEENSLAND:** Daintree National Park, Mossman Gorge, 16° 29' S, 145° 23' E, 50 m, tropical rainforest, foliicolous, 2. IX. 1992, K. & A. Kalb 26820 (CANB, holotype; hb. KALB, isotype).

Description: Thallus foliicolous, 20-30 mm across or sometimes covering large areas of the leaf, smooth, pale greenish grey, 20-30 μm thick. Rounded to irregular soralia present, 0.2 mm broad, partly confluent, with pale greenish, finely granular soredia.

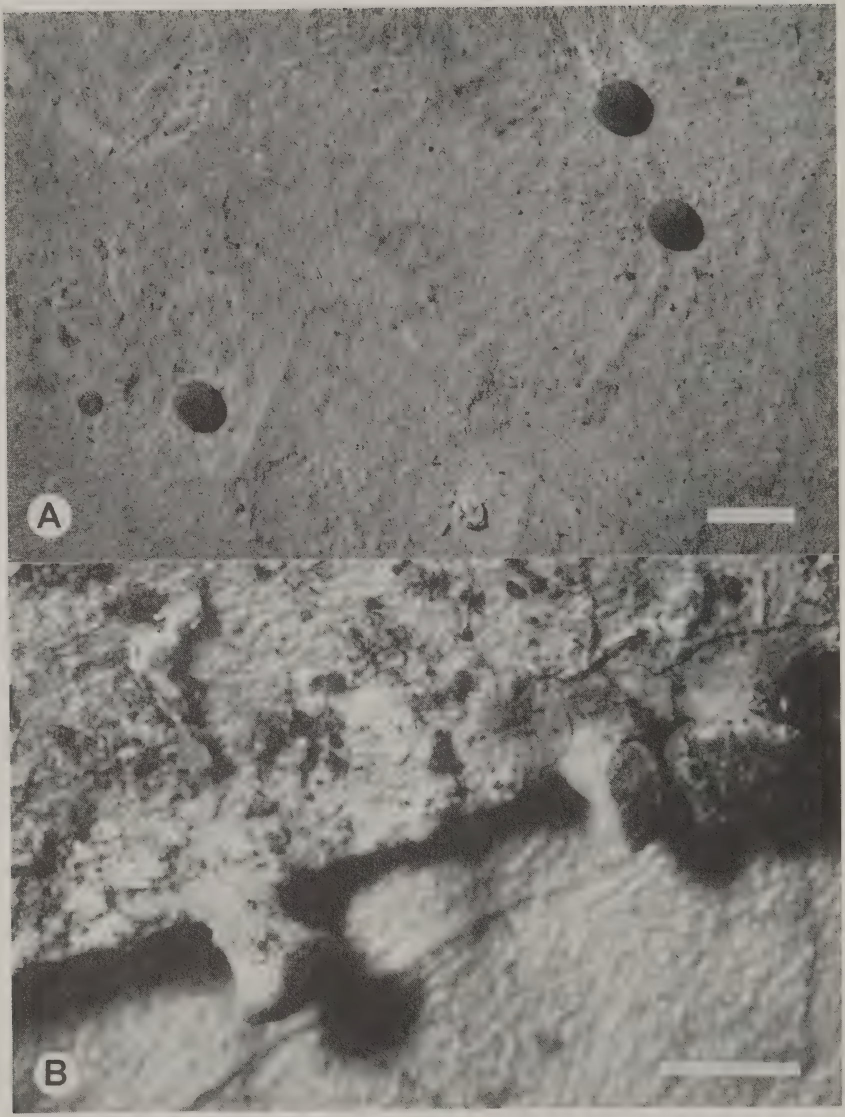

Figure 5: General habit of *Bapalmuia* species. (A) *B. palmularis* [Ecuador, Lücking 96-574 (hb. LÜCKING)], thallus with epiphyllous apothecia. Note the convex disc with evanescent margin. (B) *B. marginalis* [PHILIPPINES, holotype], marginally hypophyllous apothecia. Scale = 1 mm.

Apothecia scattered, usually marginally hypophyllous on a mycelium free of algae, rarely epiphyllous on the thallus surface, sessile, regularly rounded, 0.5-0.8 mm in diam.; disc orange to dark reddish brown, strongly convex when old, non-pruinose; margin thin, in mature apothecia disappearing, chamois-coloured to beige. Exciple well-developed, up to 100 μm thick, pale yellowish brown, laterally besides the hymenium prosoplectenchymatous with radiating cell rows but otherwise paraplectenchymatous with 4-10 μm broad cells; hypothecium centrally up to 150 μm high, pale yellowish brown; epithecium not developed; hymenium 140-170 μm high. Asci narrowly cylindrical, 70-85 × 6-10 μm. Ascospores 8 per ascus, in a regular bundle, (8-) 12-16-septate, 40-55 × 3.0-3.5 μm. Pycnidia not observed. Chemistry (HPTLC): 4,5-dichlorolichexanthone = coronatone.

Notes: *Bapalmuia sorediata* is easily recognized by its thallus provided with abundant, rounded to irregularly maculate soralia. A second species with similar thallus and apothecial morphology described below is *B. variratae*, which differs from *B. sorediata* only by the longer ascospores with more numerous septa. Soralia are otherwise known to occur occasionally in *B. lineata* and *B. verrucosa*, but the thallus of these species differs clearly in the presence of radiate ridges or verrucae.

Although the apothecia of *B. sorediata* are morphologically similar to those of *B. palmularis*, it cannot be regarded as a sorediate modification of the latter, since its ascospores are shorter and its excipular structure differs from all other species of the genus. Indeed, *B. sorediata* provides a transition towards *Bacidia brasiliensis* and other species currently included in *Bacidia* s. lat. with entirely paraplectenchymatous excipulum, and underlines the close relationship of this latter group with *Bapalmuia*. Its inclusion in *Bapalmuia* is justified, however, because of the general apothecial morphology (convex disc and evanescent margin) and the presence of coronatone instead of zeorin.

Distribution and ecology: *Bapalmuia sorediata* is so far only known from two collections, but it seems to have the same ecological preferences as the other foliicolous species of the genus.

Additional specimen examined: AUSTRALIA. **QUEENSLAND:** Maleny, Mary Cairncross Park, 40 km W of Caloundra, 26° 47' S, 152° 51' E, 440 m, dense, subtropical rainforest, foliicolous, 2. VIII. 1995, K. & A. Kalb (hb. KALB 32852).

Bapalmuia variratae Sérus. spec. nova

Species nova similis *Bapalmuiae sorediatae*, sed differt ascosporis maioribus (80-100 × 2-3 μm) 15-25-septatis. – Type: PAPUA NEW GUINEA. **CENTRAL PROVINCE:** Varirata National Park, 22 km E of Port Moresby, 9° 26' S, 147° 21' E, 800 m, tropical rainforest remnants along stream, foliicolous, 23. X. 1995, Sérusiaux s.n. (LG, holotype; hb. Lücking, isotype).

Description: Thallus epiphyllous, covering large areas of the leaf, smooth, pale greenish grey. Rounded to irregularly maculate soralia dispersed over the thallus surface, 0.3-1.8 mm broad, partly confluent,

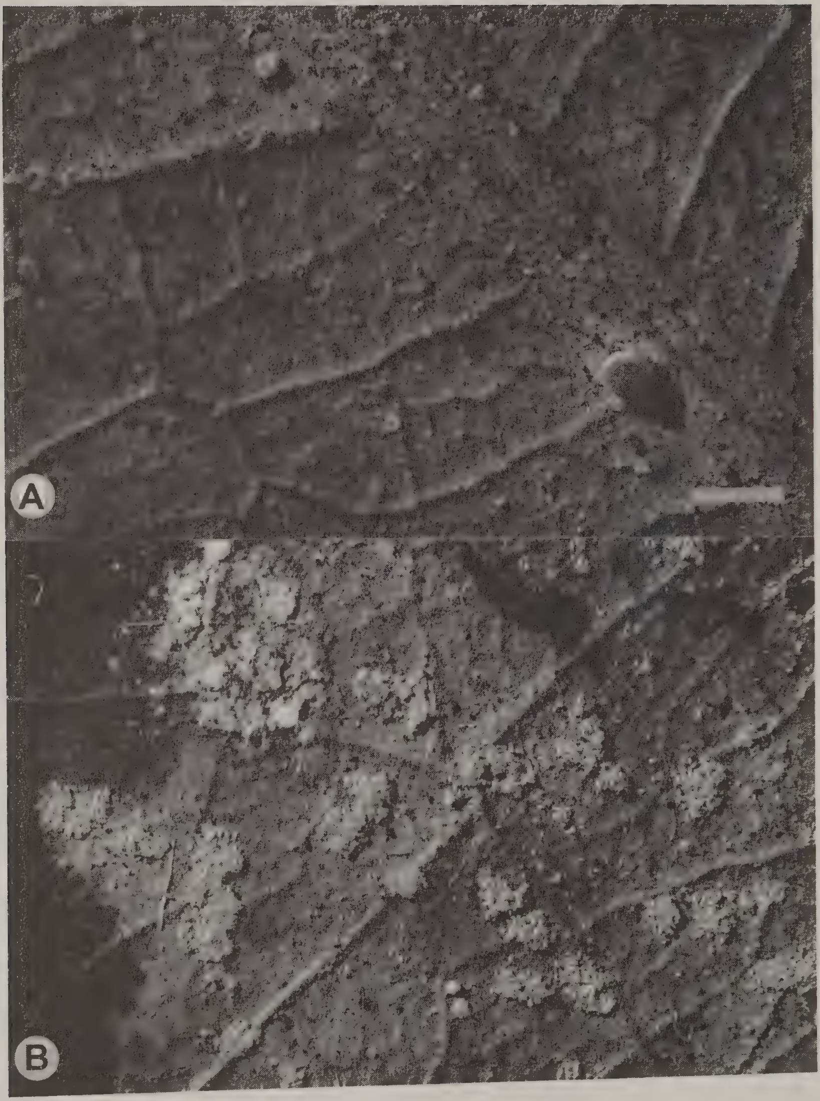

Figure 6: General habit of *Bapalmuia* species. (A) *B. variratae* [hb. LÜCKING, isotype], thallus with young and premature apothecium. (B) *B. variratae* [hb. LÜCKING, isotype], thallus with maculate soralia. Scale = 1 mm.

with pale greenish, finely granular soredia. Apothecia scattered, epiphyllous or marginally hypophyllous on a mycelium free of algae, sessile, regularly rounded, 0.4-0.7 mm in diam.; disc orange brown, convex when old, non-pruinose; margin thin, chamois-coloured to beige. Exciple well-developed, 140-180 µm thick, colourless to pale yellowish, laterally besides the hymenium prosoplectenchymatous with radiating cell rows (cells 1-3 µm broad), otherwise paraplectenchymatous (cells 4-10 µm broad); hypothecium centrally up to 70 µm high, pale yellowish; epithecium not developed; hymenium 120-160 µm high. Asci narrowly cylindrical, 90-120 × 8-10 µm. Ascospores 8 per ascus, in a regular bundle, needle-shaped, 15-25-septate, 80-100 × 2-3 µm. Pycnidia not observed. Chemistry: 4,5-dichlorolichexanthone = coronatone.

Notes: *Bapalmuia variratae* is morphologically identical with *B. sorediata*, including its typical excipulum, and with some hesitation we describe this taxon as a separate species. The only difference between the two taxa are the ascospores, which are much longer in *B. variratae* and provided with more numerous septa. Considering ascospore variation in other species of the genus, it is unlikely that the same species can produce ascospores of such different size. On the other hand, the needle-shaped ascospores in *Bapalmuia* are often difficult to observe and easily break into parts outside the asci. However, broken ascospores are recognized by the presence of a very thin gelatinous sheath at their broken ends, and careful examination showed that even entire ascospores in *B. sorediata* do not exceed 55 µm in lenght.

Distribution and ecology: Although *Bapalmuia sorediata* is so far only known from the type collection, it seems to have the same ecological preferences as the other foliicolous species of the genus.

Bapalmuia verrucosa Sérus. & Lücking

in LÜCKING et al., Lichenologist **30:** 177 (1998). – Type: BRAZIL. **AMAZONAS:** Manaus, foliicolous, V. 1961, G. E. P. Peres 15486 (URM 22249, holotype!).

Description: Thallus foliicolous, verrucose, verrucae typically orange brown (thus far found only in the type material), in other specimens pale; irregular maculate soralia and dark prothallus sometimes present. Apothecia usually marginally hypophyllous on a mycelium free of algae, regularly rounded, 0.7-1.0 mm in diam.; disc strongly convex, reddish to blackish brown, non-pruinose; margin thin, chamois-coloured, soon disappearing. Excipulum prosoplectenchymatous with radiating cell rows, 70-150 µm broad; hypothecium centrally 150 µm high, reddish brown; epithecium indistinct; hymenium 250 µm high. Asci narrowly cylindrical, 180-200 × 9-12 µm. Ascospores 4 (-8) per ascus, in a bundle, 31-37-septate, 160-190 × 3.0-3.5 µm, 50-60 times as long as broad. Pycnidia not observed. Chemistry: not studied.

Notes: *Bapalmuia verrucosa* is easily recognized by the combination of verrucose thallus and large ascospores. The verrucae are not elongate as in *B. lineata* and, at least in the type collection, are of a different, very characteristic colour. The collections cited below differ from the type in having pale verrucae but are provisionally included here.

Distribution and ecology: A foliicolous species known from Brazil (type) and (with pale verrucae) from Guyana, Brazil and Ecuador. Probably restricted to South America (Amazon), where it exhibits the same ecological preferences as the other species of the genus.

Selected specimens examined (all with pale verrucae): GUYANA. **POTARO/SIPARUNI:** Paramakatoi village, 4° 42' N, 59° 43' W, 500-800 m, tropical submontane moist forest, foliicolous, II. 1996, R. Lücking 96-3790 (hb. Lücking). — ECUADOR. **NAPO:** Jatun Satcha Biological Station, 25 km E of Tena at Río Napo, 1° 04' S, 77° 35' W, 450 m, lowland to submontane rainforest, foliicolous, V. 1996, R. Lücking 96-984 (hb. Lücking). — BRAZIL. **PARÁ:** Near Belém, 1° 00' S, 49° 00' W, 10 m, lowland rainforest, foliicolous, X. 1980, K. Kalb 32717 (hb. Kalb).

Doubtful and excluded species

Bapalmuia kakouettae **Sérus.**

Nord. J. Bot. **13:** 449 (1993). – Type: FRANCE. **PYRÉNÉES-ATLANTIQUES:** Gorges de Kakouetta (SE de Tardets-Sorholus), 400 m, sur *Buxus*, VII. 1985, Sérusiaux 7703 (LG, holotype!; hb. LÜCKING, isotype!).

Byssoloma aptrootii Sérus., Nord. J. Bot. **13:** 451 (1993). – Type: PORTUGAL. **MADEIRA:** Route Ribeira Brava-São Vicente, un peu au N du col de Boca de Encumeada, 800 m, laurisylve ± dégradée le long d'une rivière, sur feuilles de *Ocotea foetens*, II. 1988, Sérusiaux s. n. (LG, holotype!; BM, E, hb. LÜCKING, hb. VEZDA, isotypes).

Notes: In the original description of *Bapalmuia*, SÉRUSIAUX (1993a) *described B. kakouettae* as an additional species in the genus. However, our more detailed studies revealed that this western European taxon differs from *Bapalmuia* as circumscribed in this paper in the structure of the excipulum: the outer part is composed of more or less free hyphae, while the inner part can be described as paraplectenchymatous. In this character, together with the relatively broad ascospores and the pyriform conidia, *Bapalmuia kakouettae* agrees with *Byssoloma aptrootii* Sérus., which was described in the same paper (SÉRUSIAUX 1993a). The now available abundant material indicates that the latter is probably a neotenic form of *Bapalmuia kakouettae* and best regarded as a synonym. The species, whose generic position is unclear at the time, is now known from SW France, S Italy and throughout Macaronesia (PUNTILLO et al. 2000), and is found on living leaves, chlorophyllous twigs and bark.

Since the excipulum structure is an important feature for the distinction of genera in the Pilocarpaceae, *Bapalmuia kakouettae* (= *Byssoloma aptrootii*) cannot be retained in *Bapalmuia*, but rather takes an intermediate position between *Fellhanera* and *Byssoloma*. A similar excipulum, partly encrusted with crystals, is known from *Byssoloma syzygii* Vezda & Vivant (VEZDA 1994) and *Fellhanera pilomarginata* Lücking (LÜCKING 1997). At least two other European species currently placed in *Bacidia* sensu lato agree with *Byssoloma aptrootii* in the excipular structure, viz. *Bacidia carneoglauca* (Nyl.) A. L. Smith and *B. viridifarinosa* Coppins & James. (see PURVIS et al. 1992; BRICAUD & ROUX 1993). These species undoubtedly belong in the Pilocarpaceae, and further studies in a forthcoming paper will attempt to clarify their taxonomical status within the family.

More than 100 taxa are currently referred to the Pilocarpaceae. Most species are rather distinctive with regard to excipulum structure, paraphyses, ascospores and conidia; they thus can be easily assigned to either *Fellhanera*, *Fellhaneropsis*, *Byssoloma*, *Byssolecania*, *Bapalmuia*, or other genera yet to be established. Intermediate forms are relatively rare, and their taxonomic status should therefore not affect generic delimitation in the family but is rather a problem of individual placement, which can only be resolved when the phylogenetic relationships of the genera involved are better understood (LÜCKING 1997).

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MYCOTAXON

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NOTES ON THE GENERA TURTURCONCHATA AND VENUSTUSPORIUM (MITOSPORIC FUNGI)

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ABSTRACT: The genus *Venustusporium* was erected to accommodate a single species, *V. chelysforme* R.F. Castañeda & Iturr. (1999). Nevertheless, the theme for establishing the genus appears superfluous to that of an earlier genus, *Turturconchata*. The new combination *Turturconchata chelysforme* is proposed for *Venustusporium chelysforme*. A key is provided for the two described species.

KEYWORDS. hyphomycetes, mitosporic fungi, nomenclature, Taiwan, Venezuela

Castañeda-Ruiz and Iturriaga (1999) described *Venustusporium* from South America. The genus is characterized by sporodochial conidiomata, reduced conidiophores and turtle-like phaeodictyosporous conidia with shizolytic secession. The etymology of the species epithet '*chelysforme*' refers to the shape of the conidia which looks like the shell of a turtle. However, in comparing the circumscription and morphological characteristics of *Venustusporium* with *Turturconchata* (Chen *et al.*, 1999), it was found that both genera share some important characters in common. *Turturconchata* consisted of a single species, *T. reticulata*, which was characterized by dorsiventrally flattened phaeodictyosporous conidia borne horizontally on a cuneiform basal cell originating from fleuxous, indeterminate conidiogenous cells. The conidia in both genera secede schizolytically and in form are reminiscent of the shell of a turtle. These two fungi seem to be closely related and the circumscription of the the genera overlaps. The name *Turturconchata* was effectively published in July (Cambridge University Press, personal communication) whilst *Venustusporium* appeared later in September (Anonymous, 1999). According to the rule of priority the generic name *Turturconchata* takes precedence and we propose a new combination for *V. chelysforme* herein.

TURTURCONCHATA J.L. Chen, T.L. Huang & Tzean, *Mycological Research* **103**: 830 (Jul. 1999).
= *VENUSTUSPORIUM* R.F. Castañeda & Iturr., *Mycotaxon* **72**: 455 (Sep. 1999).

Turturconchata chelysforme (R.F. Castañeda & Iturr.) Chao H. Chung & Tzean, ***comb. nov.***
≡ *Venustusporium chelysforme* R.F. Castañeda & Iturr., *Mycotaxon* **72**: 456 (1999).

Comparison of the two known species of *Turturconchata* clearly indicated marked difference in size and marginal shape of the conidia, which readily separates these two species (Table 1). In addition, the habitats of *T. reticulata* and *T. chelysforme* are different. *Turturconchata reticulata* was isolated from a decaying herbaceous dicotyledon stem in northern Taiwan (Chen *et al.*, 1999) whereas *T. chelysforme* was found on fallen, rotted leaves of the monocotyledon *Bactris setulosa* (Arecaceae). Castañeda-Ruiz & Iturriaga (1999) noted that *Turturconchata chelysforme* produced sporodochial conidiomata on natural substrata although they were unable to obtain a sporulating culture. In the type species, *T. reticulata*, only some 'clustered conidiophores' were observed (Chen *et al.*, 1999). This is probably because the identification and description of this species was based on cultures growing on oat meal agar. Further field works may help to clarify the exact conidiomatal morphology of *T. reticulata* on natural substrata. To aid the identification of the two species, a key is proposed.

Key to the species of *Turturconchata*

1 Basal cell 1·5–3.5 × 3·5 µm, conidia 14–25 × 13–23·5 µm, comprising 19–58 cells per conidium, margin irregular to crenate....................... .... *T. reticulata*
1' Basal cell 5–6 × 3·5–5 µm, conidia 55–75 × 50–65 µm, comprising 30–72 cells per conidium, margin uncinate to horn-like projected .... *T. chelysforme*

Table 1. Comparison of the morphological characters of the two known species of *Turturconchata*

Character	*T. reticulata*	*T. chelysforme*
number of cells per conidium	19–58	30–72
conidial dimension	14–25 × 13–23·5	55–75 × 50–65 μm
basal cell (pedicel)	1·5–3.5 × 3·5	5–6 × 3·5–5 μm
peripheral margin of conidium	irregular, somewhat crenate	uncinate to horn-like projected

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Chen, J. L., T. L. Huang & S. S. Tzean. 1999. *Turturconchata*, a new genus of hyphomycetes from Taiwan. *Mycological Research* **103**(7): 830–832.

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GOLOVINOMYCES HYOSCYAMI ON HYOSCYAMUS NIGER IN TURKEY

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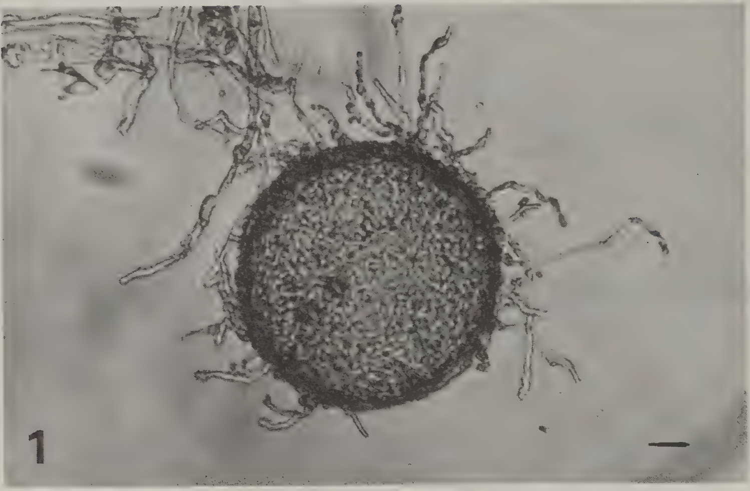
Golovinomyces hyoscyami on *Hyoscyamus niger*, new on this host for Turkey, is described and illustrated.

Key words: *Hyoscyamus niger, Golovinomyces hyoscyami*, Turkey

Powdery mildew symptoms have been observed on plants of *Hyoscyamus niger* growing in the Agronomy Research Farm of the Ankara University. The causal agent of this disease has been identified as *Golovinomyces hyoscyami* (R.Y. Zheng & G.Q. Chen) V.P. Gelyuta [= *Erysiphe hyoscyami* R.Y. Zheng & G.Q. Chen] (Braun, 1987, 1995, 1999). The collections concerned are characterized by the following microscopical features:



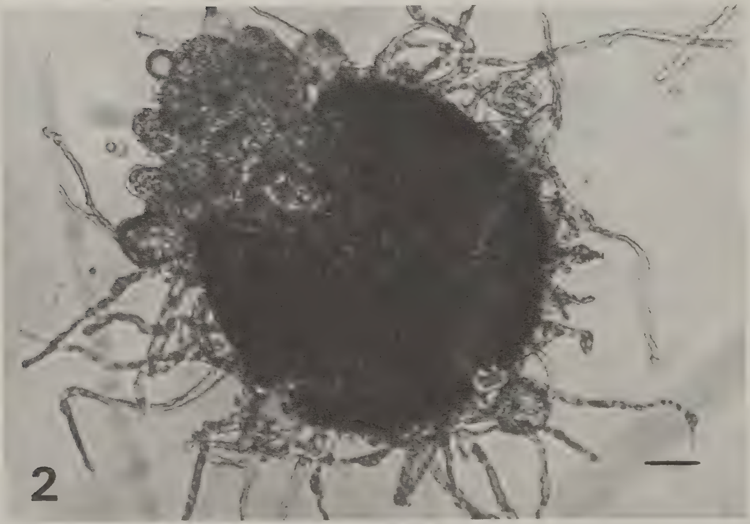


Figure 1. Cleistothecium and hyphal appendages of *Golovinomyces hyoscyami*. Figure 2. Cleistothecium and asci of *Golovinomyces hyoscyami*. Bar = 20 μm.

Conidia in chains, ellipsoid-cylindrical, 22-40 x 13-19 µm, average 30 x 16 µm; cleistothecia gregarious, subscattered, often immersed in dense mycelium, (89) 114 (143) µm; outer peridial cells irregularly shaped, ca. 15 µm; appendages mycelium like (Figure 1), generally shorter than the cleistothecial diameter, ca. 6 µm wide, hardly separable from the hyphae; asci numerous (Figure 2), stalked, (55) 70 (84) µm x (20) 29 (38) µm; ascospores ellipsoid-ovoid, 2(3), 19 x 14 µm.

Golovinomyces hyoscyami is widespread in Europe, and also known from Central Asia, China and Siberia (Braun, 1987, 1995). *Hyoscyamus reticulatus* is known as host species of this species from Turkey (Tamer *et al.*, 1997), but *H. niger* is a new host record for this country.

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TRICHIA PERICHAENOIDES, A NEW MYXOMYCETE ASSOCIATED WITH DECAYING SUCCULENT PLANTS

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ABSTRACT

A new succulenticolous *Trichia*, *T. perichaenoides*, very similar in habit to *Perichaena corticalis*, is described from decaying *Agave* and *Opuntia*. It was recorded from a number of different sites in the Old and New World (Canary Islands, Peninsular Spain and Mexico). The most important morphological or morphotaxonomic features of the new species are the sessile, clustered sporocarps with circumscissile or reticulated dehiscence, the elateriform capillitium, with very faint sinistrorse, spiny spirals only noticeable with oil immersion or SEM, and with blunt tips, and the normally double peridium with attached outgrowths.

Key Words: Mexico, *Perichaena*, Spain, succulent plants, taxonomy

INTRODUCTION

In the course of a survey on the succulenticolous myxobiota of arid and semiarid lands in different parts of the world (Estrada-Torres, 1999; Estrada-Torres et al., 1999; Lado et al., 1999; Mosquera et al., 1999), specimens were collected from *Agave* and *Opuntia* debris in Spain (including the Balearic Islands and the Canary Islands), which we tentatively assigned to *Perichaena corticalis* (Batsch) Rostaf. due to sessile sporocarps and circumscissile dehiscence. Nevertheless, after a careful examination of the capillitium by LM and differential interference microscopy, the presence of elaters with very faint but constant spiny spirals, similar to those of the genus *Trichia,* were observed. The same features were observed in other collections from Mexico. Due to its habit, method of dehiscence, capillitial ornamentation and field ecology, this taxon is an undescribed species new to science.

MATERIALS AND METHODS

This study is based on material directly collected in the field and from moist chamber cultures. The collections are deposited in the herbaria MA-Fungi, TFC Mic, TLXM, GB and BPI.

All microscopic measurements were made with material mounted directly in Hoyer´s medium. The critical-point dried material technique was employed for all of the SEM-pictures. For moist chamber and agar culture techniques see Lado et al. (1999). Color notations in parentheses are from the ISCC-NBS Color-Name Charts Illustrated with Centroid Colors (Anonymous, 1976).

RESULTS

Trichia perichaenoides Mosquera, Lado, Estrada et Beltrán-Tej. sp. nov.
Figs. 1-15

Perichaenae corticali similis dehiscendi modo atque gregario habitu; ab ea tamen differens capillitio tubulis 2,5-3 µm diam. constituto, 4-7 fasciis spiralibus tenuibus atque spinosis ornatis, et quoad utrumque extremum obtusatis.

HOLOTYPE. SPAIN. CANARY ISLANDS: Tenerife, Anaga Peninsula, Jardina, 28RCS7455, 850 m, on decaying *Agave americana* leaves, 9-XII-1995, *J. Mosquera* (TFC Mic 7319, ISOTYPE in MA-Fungi 41873 slide only, and GB).

Sporophores sporocarpic, rarely plasmodiocarpous, sessile, clustered. Sporocarps subglobose, slightly depressed, sometimes laterally compressed due to mutual pressure, 0.1-0.7 mm diam. Plasmodiocarps fusiform, 0.8-1 mm long. Sporotheca dark orange-yellow (72. d. OY) to dark yellowish brown (78. d. y Br), sometimes blackish. Hypothallus common to a group of sporophores, membranous, moderate yellowish brown (77. m. y Br) to dark yellowish brown (78. d. y Br), sometimes as a white thinly drawn out membranous sheet joining adjacent sporophores, or inconspicuous. Peridium double, partially evanescent, persistent at the base; outer layer thick, opaque, strong orange-yellow (68. s. OY) by transmitted light, with abundant granular refuse matter, sometimes absent; inner layer attached to the outer layer, thin, membranous, translucent, light yellow (86. l. Y) by transmitted light, smooth or with faint striations in different directions, sometimes with ridges limiting depressions, that probably correspond to the spore impressions; dehiscence circumscissile, through a lighter line without refuse matter, often in a reticulate pattern, or irregular when there is not an outer peridial layer. Columella absent. Capillitium mostly elateriform; threads tubular, hollow, non chambered, elastic, vivid yellow (82. v. Y) in mass, vivid yellow (82. v. Y) to strong orange-yellow (68. s. OY) by transmitted light, 2-3 µm diam., simple, rarely branched, with blunt tips, ornamented with spinules 1-4 µm long, on 4-7 faint sinistrorse spiral bands only visible with immersion oil and clearly visible by SEM; occasionally hollow peridial outgrowths and detached capillitial threads similar to those of *Perichaena* may appear, narrower and lighter than the elaters and without spirals nor spines. Spores free, vivid yellow (82. v. Y) in mass, strong yellow (84. s. Y) by transmitted light, subglobose to slightly angular, 12-15(16) µm diam., densely spinulose. Plasmodium unknown.

Etymology. Refers to the morphological similarities with the genus *Perichaena*.

Habitat. On decaying leaves of *Agave*, *Yucca* and *Hechtia*, and on decaying *Opuntia ficus-indica* (L.) Miller cladodia.

Distribution. Known from the Iberian Peninsula (Spain), Canary Islands and Mexico. Possibly occurring in other regions of the world where succulent plants are present.

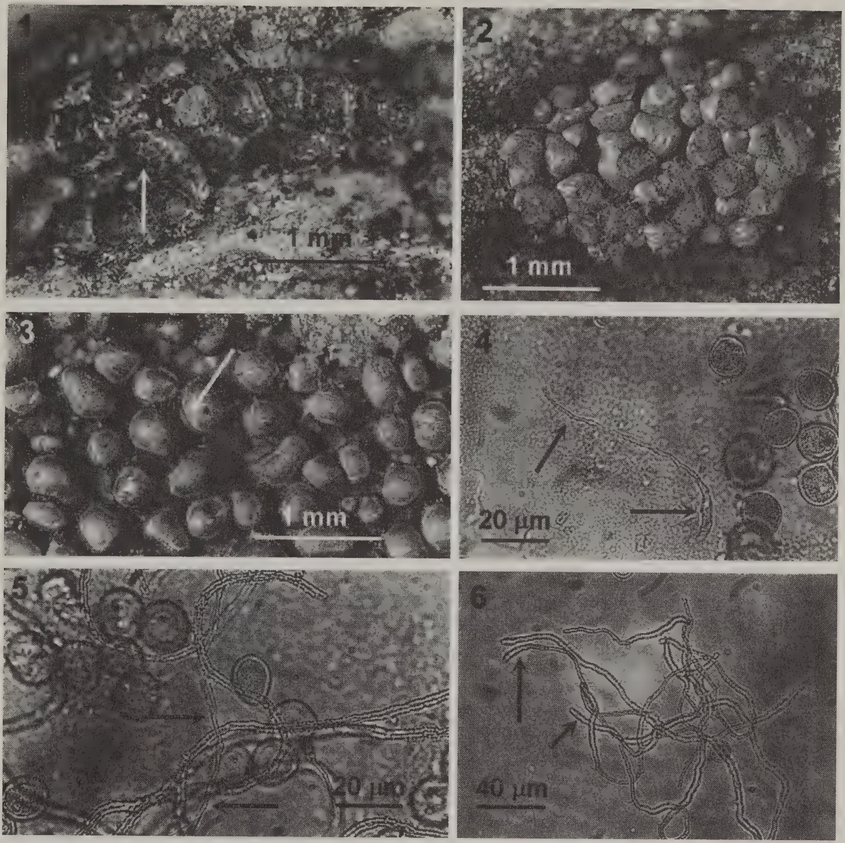
Specimens examined. **SPAIN.** CANARY ISLANDS: Tenerife, Anaga Peninsula, Jardina, 28RCS7455, 850 m, on dead leaf of *Agave* sp., 9-XII-1995, TFC Mic 7319 (Holotypus). Isotype in MA-Fungi 41873, slide only, and GB. *Idem*, TFC Mic 7320 (duplicate in MA-Fungi 41874, slide only), 7324 (duplicate in MA-Fungi 41875). Paratype: *Ibidem*, obtained in moist chamber culture, 21-XII-1995, TFC Mic 7349 (duplicate in MA-Fungi 41876), 7408 (duplicate in MA-Fungi 41877), 7482. Tenerife, Valle de Guerra, El Boquerón, 28RCS6453, 525 m, on the inner side of the epidermis of decaying *Opuntia ficus-indica* cladodium, 21-II-1998, TFC Mic 8422 (duplicate in MA-Fungi 41878), 8430. *Ibidem*, obtained in moist chamber culture on 25-II-1998, TFC Mic 8527, 8660. La Gomera, Degollado de Peraza, 28RCS8510, 800 m, 13-I-1990, TFC Mic 8658. PENINSULAR SPAIN. ALMERíA: San José, playa Morrón de los Genoveses, 30SWF7867, 10 m, on dead leaf of *Agave americana,* 1-I-1987, 1949Lado (MA-Fungi 41879). *Idem,* 1950Lado (MA-Fungi 41880). VALENCIA: Castelló de Rugat, Albaida road, 30SYJ2606, 320 m, on dead leaf of *Agave americana,* 2-I-1994, 765.Oltra (MA-Fungi 32828). Oliva, dunas de Aguas Blancas, L'Aigua Blanca, 30SYJ5311, 1 m, on dead leaf of *Agave americana,* 5-I-1997, 1859. Oltra (MA-Fungi 39851). *Idem,* 1860. Oltra (MA-Fungi 39852). BALEARIC ISLANDS: Ibiza, San Juan Bautista, 31SCD7025, 160 m, on dead leaf of *Agave sp*., 17-XI-1994, 7092Lado (MA-Fungi 34842). **MEXICO.** HIDALGO: El Cardonal, San Cristobal, 20°36'53" N, 98°59'12" W, 1830 m, on dead leaf of *Agave* sp., 14-X-1999, TLXM *sub A. Estrada-Torres* 5769 (MA-Fungi *sub C. Lado* 11190); *ibidem* TLXM *sub A. Estrada-Torres* 5789 (MA-Fungi *sub C. Lado* 11210); *ibidem* TLXM *sub A. Estrada Torres* 5791 (MA-Fungi *sub C. Lado* 11212); 20°36'21" N, 99°00'00" W, 1800 m, on dead leaf of *Yucca* sp., 14-X-1999, TLXM *sub A. Estrada-Torres* 5804 (MA-Fungi *sub C. Lado* 11225); *ibidem*, TLXM *sub A. Estrada-Torres* 5814 (MA-Fungi *sub C. Lado* 11235); Epazoyucan, Xochihuacan, 19°59'12" N, 98°42'15" W, 2400 m, on dead leaf of *Yucca* sp., 12-X-1999, TLXM *sub A. Estrada-Torres* 5581 (MA-Fungi *sub C. Lado* 11001); *ibidem*, on dead leaf of *Agave* sp., TLXM *sub A. Estrada-Torres* 5611 (MA-Fungi *sub C. Lado* 11031); Mesquititlán, Km 66 federal road 105, 20°28'27" N, 98°40'19" W, on dead leaf of *Agave* sp., 18-XII-1998, TLXM *sub A. Velasco-Ramírez* 525; Santiago de Anaya, Patria

Nueva, Km 49 federal road 85, 20°21'50" N, 99°02'35" W, 1920 m, on dead leaf of *Hechtia* sp., 12-X-1999, TLXM *sub A. Estrada-Torres* 5644 (MA-Fungi *sub C. Lado* 11064); *ibidem* TLXM *sub A. Estrada-Torres* 5653 (MA-Fungi *sub C. Lado* 11073). OAXACA: Km 97 federal road 135, 18°04'23" N, 97°21'09", on dead leaf of *Yucca* sp., 08-X-1999, TLXM *sub A. Estrada-Torres* 5494a (MA-Fungi *sub C. Lado* 10914a). PUEBLA: Chapulco, Km 21 federal road 135, 18°38'23" N, 97°27'33" W, 2220 m, on dead leaf of *Agave* sp., 8-X-1999, TLXM *sub A. Estrada-Torres* 5511 (MA-Fungi *sub C. Lado* 10931); *ibidem* TLXM *sub A. Estrada-Torres* 5517 (MA-Fungi *sub C. Lado* 10937); *ibidem*, TLXM *sub A. Estrada-Torres* 5541 (MA-Fungi *sub C. Lado* 10961); *ibidem*, TLXM *sub A. Estrada-Torres* 5575 (MA-Fungi *sub C. Lado* 10995); Palmar de Bravo, federal road 135, motorway Puebla-Orizaba, 18°49'10" N, 97°29'27" W, 2400 m, on dead leaf of *Agave* sp., 8-X-1999, TLXM *sub A. Estrada-Torres* 5549 (MA-Fungi *sub C. Lado* 10969); *ibidem* TLXM *sub A. Estrada-Torres*-5550 (MA-Fungi *sub C. Lado* 10970); Santiago Miahuatlán, Km 26 federal road 135, on dead leaf of *Agave* sp., 5-X-1999, TLXM *sub A. Estrada-Torres* 5379 (MA-Fungi *sub C. Lado* 10799); Km 69 federal road 135, 18°16'40" N, 97°19'40" W, 1230 m, on dead leaf of *Agave* sp., 8-X-1999, TLXM *sub A. Estrada-Torres* 5509 (MA-Fungi *sub C. Lado* 10929); Tehuacán, Km 32 federal road 135, 18°32'58" N, 97°27'42" W, 1770 m, on dead leaf of *Yucca* sp., 5-X-1999, TLXM *sub A. Estrada-Torres* 5368 (MA-Fungi *sub C. Lado* 10788). TLAXCALA: Ixtacuixtla, Km. 10.5 motorway Texmelucan-Tlaxcala, 19°19'56" N, 98°21'57" W, 2160 m, on dead leaf of *Agave* sp., 21-X-1999, TLXM *sub A. Estrada-Torres* 6314. VERACRUZ: Totalco, Km 86 federal road 140, on dead leaf of *Agave* sp., 2-X-1999, TLXM *sub A. Estrada-Torres* 5243 (MA-Fungi *sub C. Lado* 10663).

DISCUSSION

The characters of *Trichia perichaenoides* overlap with those observed in various myxomycete genera. It is similar to *Perichaena corticalis* (Batsch) Rostaf., *P. depressa* Lib. and *P. brevifila* T.E. Brooks & H.W. Keller, in habit due to its sessile sporocarps, often aggregated or clustered, and often with circumscissile dehiscence by means of a lighter area free of refuse matter (Figs. 1-3). Nevertheless, the species we describe always possesses abundant simple elaters with blunt tips, bearing faint sinistrorse and spinulose spirals (Figs. 5, 6, 8-11), which is typical in species of *Trichia*, and lacks the chambered capillitium frequently seen in *Perichaena*. (Keller and Eliasson, 1992) (Figs. 5, 6, 12). The spores are spinulose (Figs. 4, 5, 7) and slightly larger than those of *Perichaena* species.

Due to the morphological variability of *Perichaena* species, our material was compared to Spanish samples of *P. corticalis* (4134Lado, TFC Mic 8403), *P. depressa* (MA-Fungi 32751, 34666, 38148, 39416), *P. chrysosperma* (Curr.) Lister (MA-Fungi 39417), as well as *Hemitrichia minor* G. Lister [=*P. minor* (G. Lister) Hagelst.] (1931Lado), which had also developed on succulent plants such as *Euphorbia canariensis, Agave* spp. and *Opuntia* spp. In all cases the specimens examined were typical, with well defined and constant features, and different from our material. In the case of specimen MA-Fungi 32751, *P. depressa* and *T. perichaenoides* (MA-Fungi 32828) were found together on the same substrate but in distinct and separate colonies, which supports the fact that the latter are not simply irregular or variable forms of other *Perichaena* species.



Figures 1-6. *Trichia perichaenoides*. 1. Sporocarps with a reticulated lighter area free of refuse matter. 2. Sporocarps from *Opuntia*. Refuse matter lacking. Peridium shines and lacks lighter area of dehiscence. 3. Sporocarps with a circumscissile lighter line and free of refuse matter. 4. Peridial outgrowth. 5. Capillitium. A *Perichaena*-like capillitial thread (arrows) is mixed with the elaters. 6. Capillitium, composed of spiny elaters. Free ends are abundant and clearly visible (arrows).

It is also true that some of the characters of *T. perichaenoides* are atypical in the *Trichia* genus and common in some *Perichaena* species. The hollow smooth peridial outgrowths which tend to bear nodular enlargements or the same ornamentation of the inner surface of the peridium (Figs. 4, 13-15) have been illustrated by Gilert (1990) when commenting on *Perichaena* species. It has also been noted in Keller (1971) and Keller and Brooks (1971). *Trichia perichaenoides* occasionally presents free *Perichaena*-like threads lacking spirals (Fig. 5) among normal and abundant elaters.

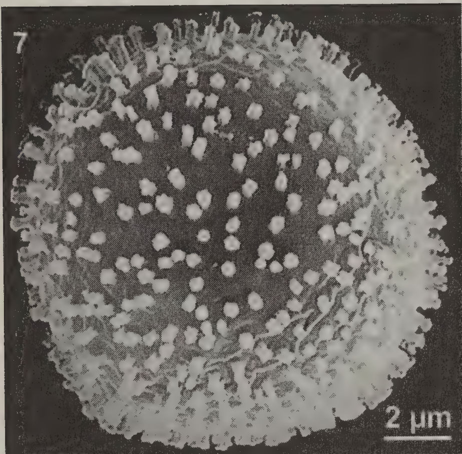
Gilert (1997) stated that, in the Trichiales, the capillitium may develop in two different ways simultaneously: as an anastomosing vacuole system and from invaginations from the plasma membrane. In the latter case the capillitial threads are attached to the peridium. In the genus *Perichaena* the capillitium seems to be formed in a combination of these, the anastomosis of vacuoles which enlarge, and by peridial invaginations. The result is a net with peridial attachments and rare free ends (Charvat et al. 1974). In *Trichia* it is thought to be formed by elongation of vacuoles that anastomose, giving rise to an unconnected system of elongated elements (Harper and Dodge, 1914). Since in *Trichia perichaenoides* invaginations from the plasma membrane are also present, as well as the formation of peridial outgrowths and *Perichaena*-like threads, the species also show similarities with *Perichaena*.

Thus the capillitium in our material shares characters of both *Trichia* and *Perichaena* (although in very different proportions). We have discarded *Perichaena* since our species lacks branching threads, so a capillitial network is never present. The capillitium is clearly elateriform, bears spirals, although very faint ones, is not porous by SEM and is not chambered, all characters of *Trichia*. Our material could be placed in the genus *Oligonema*, but the sporophores are not superimposed or heaped, the peridium generally has a granular layer so is not iridescent and the elaters are generally longer and with a more regular ornamentation than in members of the genus *Oligonema*.

Trichia perichaenoides may also be mistaken for *Hemitrichia minor* G. Lister. It shares its habitat and possesses capillitium with spinulose spirals, which are sometimes difficult to see. Nevertheless *H. minor* is distinguished by its sporocarps, which are grouped and subglobose instead of clustered and slightly depressed, lacking an area of dehiscence, and capillitium is a net with swellings instead of elateriform.

The spirals of *T. perichaenoides* are barely observable by LM, thus differing from other species of the genus *Trichia*. Nevertheless they are clearly visible by SEM (Figs. 8-10). The spirals in our species, according to the terminology of Eliasson and Keller (1999), are constantly sinistrorse, as they are in *T. elaterensis* (Mulleavy) Lado and *T. brunnea* J.J. Cox. *Trichia elaterensis (=Arcyria elaterensis* Mulleavy) has a branched capillitium but it is clearly elateriform, often with clavate

Figures 7-15. *Trichia perichaenoides* (SEM). 7. Spore. 8-10. Elaters. 10. Spirals bear spines. 11. Typical blunt end. 12. Hollow elater. 13-15. Peridial outgrowths with nodular enlargements and the same ornamentation as the inner surface of the peridium: lines, smooth surface and abundant grooves.


7
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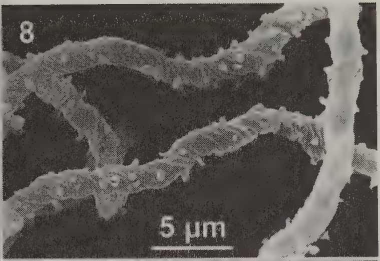
8
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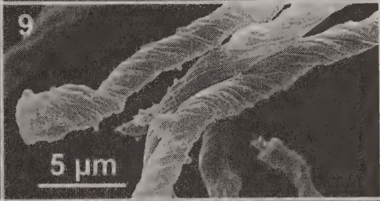
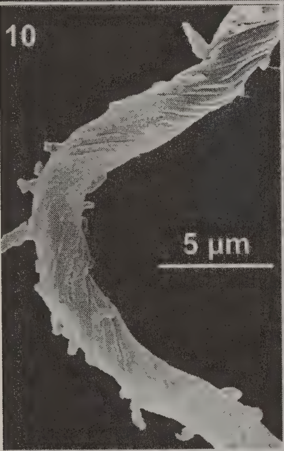
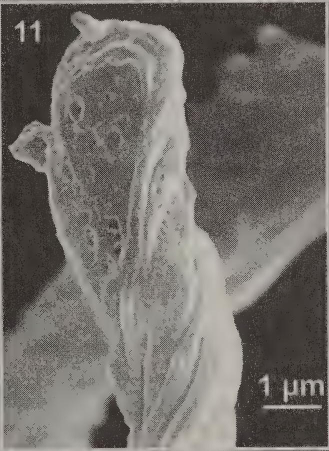
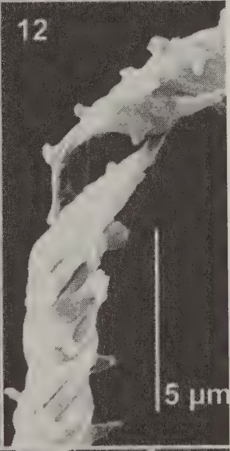
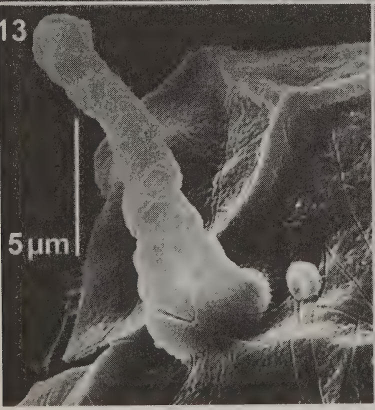
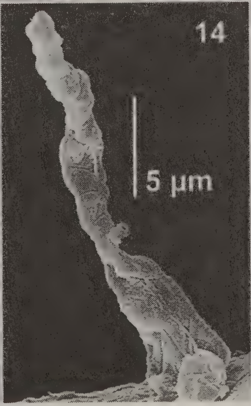

9
5 µm


10
5 µm


11
1 µm


12
5 µm


13
5 µm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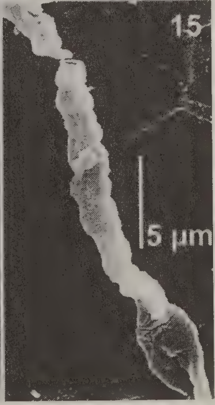
5 µm


15
5 µm

tips, and inconspicuous sinistrorse spirals on the threads (Mulleavy, 1977). Lado (in Lado and Pando, 1997) transferred it to *Trichia* using the same criterion we now use with the species we describe: the presence of an elateriform capillitium ornamented with spirals.

Some other *Trichia* species do resemble *T. perichaenoides*. *Trichia contorta* var. *iowensis* (T. Macbr.) Torr. possesses sessile sporophores, double peridium and spinulose elaters, but lacks the dehiscence area of *T. perichaenoides* and the capillitial spiral bands are more prominent, irregular and asymmetrical. Other sessile and subglobose *Trichia* species are *T. varia* (Pers. ex J.F. Gmel.) Pers., *T. scabra* Rostaf. and *T. lutescens* (Lister) Lister, but the first differs in having two prominent spiral bands (*vs.* 4-7) and long sharp tips; *T. scabra* has delicately reticulate spores, and *T. lutescens* does not usually form crowded fruitings, its peridium is single, without granular deposits and elaters lack spines (Martin and Alexopoulos, 1969; Nannenga-Bremekamp, 1991; Lado and Pando, 1997). The restricted habitat where this new species has always been found is very distinctive as well.

The features of *T. perichaenoides* seem to support the apparently close phylogenetic relationship between the *Arcyria-Hemitrichia-Trichia* complex and *Perichaena*. Spore to spore cultures and developmental and molecular studies should be undertaken to solve the questions about this complex.

The material from *Opuntia* (both directly collected in the field and obtained from moist chamber) differs in lacking the outer peridial layer of refuse matter. Thus the sporophores shine and lack the lighter circumscissile area of dehiscence (Fig. 2). Nevertheless capillitial morphology and ornamentation, as well as spore size, are the same. This difference can be correlated with the substrata where the plasmodium feeds and fructifies. López-Sánchez et al. (1986) stated that sporophore characteristics may be very variable in some species when developed on *Opuntia* and species such as *Licea biforis* Morgan may lack the outer peridial layer of refuse matter when they are cultured on agar (McManus, 1966). Another possibility is that this *Opuntia* material could belong to a close but different taxon. The obvious way to determine whether the different features of samples from *Opuntia* are genetic, or due to environmental conditions, and definitely separates our material from *P. corticalis*, is to culture material from *Opuntia* and *Agave*. We have sown spores on twenty plates of 2% oatmeal agar and 2% *Opuntia* skeleton decoction agar and ten on 2% *Agave* leaves decoction agar but so far these culture attempts have failed.

In summary, the combination of the habit, the method of dehiscence, and the type and ornamentation of the capillitium, unique in this material, indicates that this is an undescribed taxon. This new species adds to the growing group of strict succulenticolous myxomycete species. Other examples are *Didymium eremophyllum* M. Blackw. et Gilb. (Blackwell and Gilbertson, 1980), *D. subreticulosporum* Oltra, G. Moreno et Illana (Oltra et al., 1997) and *Cribraria zonatispora* Lado, Mosquera et Beltrán-Tej. (Lado et al., 1999).

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NOMENCLATURAL CHANGES IN AMANITA

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Summary

A new name at species rank is proposed for *Amanita crocea* var. *aurantiofulva.* Further it is proposed that *Amanita crocea* var. *subnudipes* be raised to species rank.

Based on my continuing studies of types in *Amanita* section *Vaginatae* (Fr.) Quél. (unpub. data), this brief note proposes a new name and a new combination.

AMANITA ROMAGNESIANA Tulloss *nom. nov.*

Replaced synonym: *Amanita vaginata* var. *fulva* f. *aurantiofulva* E. J. Gilb. 1918. *Gen. Amanita Pers.*: 145.

≡*Amanita vaginata* subsp. *fulva* f. *aurantiofulva* (E. J. Gilb.) Konr. & M. 1924. *Icon. Sel. Fung.* 6: 33.

≡*Amanita crocea* var. *aurantiofulva* (E. J. Gilb.) Romagn. 1992. *Bull. Trimestriel Soc. Mycol. France* 108: 80, 86.

Etymology: In honor of prof. H. Romagnesi, Paris.

AMANITA SUBNUDIPES (Romagn.) Tulloss *comb. nov.*

Basionym: *Amanita crocea* var. *subnudipes* Romagn. 1982. *Bull. Trimestriel Soc. Mycol. France* 98(2): 166.

≡*Amanitopsis crocea* var. *subnudipes* (Romagn.) Wasser. 1992. *Fl. Fung. Ucrainicae, Basidiomycetes, Amanitales*: 152.

DISCUSSION and KEY

In his review of the present paper, Dr. Z. L. Yang proposed that I add a brief note on characters segregating the treated taxa from each other and from the type variety of *Amanita crocea* (Quél. *in* Bourd.) Sing. In order to provide this information concisely in what is intended only as a brief note, a key to the related taxa in *Amanita* section *Vaginatae* is provided here. This key is based on extensive data that will be published as soon as practicable. In the key, *A. romagnesiana* is provisionally placed in a separate stirps from *A. crocea* and *A. subnudipes* for reasons that will be apparent. To balance the set of branch points in the key, a provisional stirps *Fulva* is also included.

Special notations within the key follow those of Tulloss *et al.* (1992) and Tulloss (1993, 1994). Color names in italic type with first letters capitalized (*e.g., Buff Yellow*) are taken from Ridgway (1912). A color illustration of *A. crocea* and an earlier provisional treatment of species in the group of interest can be found in (Tulloss, 1998). A color illustration of *A. flavescens* and a key (in Norwegian) based on Norwegian records including recent collections can be found in (Tulloss & Gulden, 1999).

The key covers those taxa in *Amanita* section *Vaginatae* that share the following characters: Universal veil membranous and firm, lacking inflated cells that darken with age; stipe always exannulate from beginning of basidiocarp expansion; basidiocarp not having the combination of a large fruiting body with a proportionately large, fleshy volval sac and occasional to common basidial clamps; suprapellis not comprising a gelatinous matrix including narrow, loosely curving, filamentous, undifferentiated hyphae; subhymenium neither ramose nor pseudoparenchymatous, with many basidia arising from partially inflated or uninflated hyphal segments, but also commonly arising from inflated cells; lamella trama having many rather large globose to subglobose to ovoid to ellipsoid cells in subhymenial base; basidial clamps absent.

1. Subhymenial base dominated by elongate, curved, intercalary inflated cells; pileus a shade of, or with a tint of, yellow or orange; upper stipe lacking a white floccose sheath; 95% of spores < 12.0 µm long. **[Stirps *Crocea*]**

2. Pileipellis divided into distinct suprapellis and subpellis—at least once plentiful spores are present on the hymenium; pileus *Buff Yellow*, rather pallid except for disc or occasionally with irregular darker areas beyond disc; lamella edge having plentiful strands of interweaving hyphae visible in side view and only scattered deciduous inflated cells; acrophysalides in stipe context < 160 µm long; spores (8.4-) 9.0 - 12.6 (-17.6) × (7.4-) 8.0 - 10.6 (-14.1) µm, with **Q** = 1.12 - 1.20; described from Sweden under *Betula* in deciduous forest; material also examined from *Betula* association in Norway...
Amanita flavescens (E. J. Gilb. & Lundell) Contu

2. Pileipellis often lacking distinct suprapellis and subpellis—with hyphae gelatinizing only at surface; pileus yellow-orange to rather pale pure orange; lamella sometimes having extensive layer of deciduous inflated cells on edge; acrophysalides in stipe context with maximum length > 290 µm.

3. Pileus yellow-orange; stipe with pale orange decoration (*e.g.*, floccose-pulverulent, zigzagged bands) or with pale orange ground and densely set with upward pointing, narrow, fibrillose squamules (at first paler than ground, but becoming darker orange than ground at least on tips); spores (8.0-) 9.4 - 11.8 (-18.8) × (7.5-) 8.5 - 11.0 (-16.0) µm, with **Q** = 1.07 - 1.10 (-1.11); described from France [material examined from Belgium, the Czech Republic, Germany, the Netherlands, Sweden, and the U.K. in association with *Alnus*, *Betula*, *Carpinus*, *Corylus*, *Fraxinus*, *Picea*, *Populus*, or *Quercus*] ....
Amanita crocea (Quél. *in* Bourd.) Sing.

3. Pileus pale pure orange or with more yellow tint; stipe white or very pale, lacking contrasting fibrillose decoration; spores (6.2-) 8.9 - 12.2 (-18.1) × (5.5-) 7.5 - 10.5 (-13.2) µm, with **Q** = 1.12 - 1.16 (-1.22); described from France from deciduous forest; additional material examined from France and Italy in association with *Fagus*, *Picea*, or *Quercus*...

Amanita subnudipes (Romagn.) Tulloss
≡ *Amanita crocea* var. *subnudipes* Romagn.

1. Subhymenial base a combination of common to plentiful filamentous, undifferentiated hyphae and common, rather broad (e.g., ovoid or ellipsoid) inflated cells.

4. Pileus marginal striations usually ≤ 0.2R; pileipellis up to 250 µm thick; 95% of specimens with **Q** ≥ 1.12. **[Stirps *Romagnesiana*]**

5. Pileus bright orange-tawny to brownish orange; saccate volva white; pileipellis fully gelatinized only at surface; spores (8.0-) 9.4 - 12.8 (-21) × (7.2-) 7.9 - 11.4 (-17.0) µm, with **Q** = (1.10-) 1.12 - 1.20; described from France from deciduous forest or mixed forest including *Picea abies* L.; additional material examined from Belgium and Germany...

Amanita romagnesiana Tulloss
≡*Amanita crocea* var. *aurantiofulva* (E. J. Gilb.) Romagn.

5. Pileus dark brown to brown-black; saccate volva dirty white with plentiful pale leather-colored to orange-leather-colored spots; pileipellis having two-thirds or more of thickness as gelatinized to partially gelatinized suprapellis; spores (10.0-) 10.5 - 13.0 (-14.0) × (9.0-) 9.5 - 12.0 (-12.5) µm, with **Q** = 1.13; described from SW China from mixed forest including *Abies* and *Quercus* [Data cited here are from the protologue.]..

Amanita brunneofuliginea Z. L. Yang (1997)

4. Pileus marginal striations usually > 0.2R; pileipellis < 100 µm thick; 95% of specimens with **Q** ≤ 1.12. **[Stirps *Fulva*]**

6. Pileus usually fulvous, sometimes pallid, sometimes fuscous over disc; pileipellis 55 - 80 µm thick, apparently lacking vascular hyphae; w_{cs} = 85 - 90 µm; w_{st}-far = 90 - 95 µm; spores (9.0-) 10.0 - 12.5 (-19.3) × (8.2-) 9.3 - 12.0 (-15.5) µm, with **Q** = 1.05 - 1.08 (-1.09); described from Bavaria, Germany; material examined from Germany, Norway, Sweden, Switzerland, and U.K. in association with *Betula*, *Fagus*, *Picea*, *Pinus*, and *Quercus*............................

Amanita fulva (Schaeff.) Fr.

6. Pileus usually dark brown to dark fulvous, often fuscous to nearly black over disc, at times paler or fulvous toward margin or (infrequently) overall; pileipellis 20 - 40 (-65?) µm thick, with locally common vascular hyphae; w_{cs} = 25 - 55 µm; w_{st}-far = 25 - 50 µm; spores (7.5-) 9.0 - 12.0 (-15.5) × (6.5-) 8.4 - 11.2 (-15.0) µm, with **Q** = (1.05-) 1.06 - 1.12 (-1.15); described from Andean Colombia with *Quercus humboldtii*; range extending north with *Quercus* at least to Honduras (additional material examined from Costa Rica and Honduras)...

Amanita fuligineodisca Tulloss, Ovrebo & Halling

In addition to wishing to honor prof. Romagnesi, in choosing the epithet "*romagnesiana*," I was concerned that the epithet "*aurantiofulva*" if raised to species rank would be confusingly similar to the specific epithet of *A. fulvaurantia* Bhatt, Locquin and Lakhanpal *in* Kumar, Bhatt and Lakhanpal (1990: 68).

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RHIZOMARASMIUS, GEN. NOV. (XERULACEAE, AGARICALES)

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ABSTRACT: A new genus name, *Rhizomarasmius*, is proposed to accommodate *Marasmius pyrrhocephalus* and *M. undatus*. Taxonomic circumscription of the family Xerulaceae is discussed, and taxonomy and nomenclature of the included species epithets are related.

KEY WORDS: Xerulaceae, Agaricales, new genus.

INTRODUCTION

As part of studies on mating systems of *Marasmius* species (Gordon and Petersen, 1991), *M. pyrrhocephalus* Berkeley was found to be tetrapolar (the norm for *Marasmius*), but its micromorphological similarity to members of the Xerulaceae was noted (unpubl. data). Subsequently, *M. undatus* (Berk.) Fr. was collected in the Caucasus area of Russia, and its similarity to Xerulaceae was also noted. It was concluded that a new genus for these species (and potentially others) was needed in order to correctly place them in the Xerulaceae, not the Tricholomataceae in which *Marasmius* has traditionally been placed.

RESULTS

Rhizomarasmius R.H. Petersen, *gen. nov.*

Genus Xerulacearum. Basidiocarpa gracile: pseudorhiza producta. Pileus convexus ad hemisphaericus; lamellae subsinuatae, crassae; stipite longa, gracile; pseudorhiza prolonga, ad dura subterranea connexa. Pileipellis: 1) hymeniiforme, cellulae inflatae; 2) pileicystidia lanceolata constructa. Trama lamellarum irregulare; hyphis fibulatis. Pleuro- et cheilocystidia prominenta, lanceolata ad subcapitata.

A genus of the Xerulaceae (*sensu* Redhead, 1987). Basidiomata gracile; pileus convex to subhemisphaerical, smooth but not glabrous or viscid, usually radially undulate, small in relation to stipe length; lamellae subsinuate, thick, not crowded, white to off-white; stipe slender and long in relation to pileus diameter, apically pale, darkening downward to fuscous or black, minutely velutinous; pseudorhiza prolonged, not inflated, black, often with ramified mycelium in humus substrate, attached to rotten, buried, small, woody twigs or other plant material.

Pileipellis a hymeniiform layer of clavate to sphaeropedunculate hyphal tips and scattered, elongate pileicystidia. Hymenium comprising basidia and pleurocystidia: pleurocystidia emergent, tapered upward to subcapitate apex (i.e. more or less ten pin-shaped), sometimes with an apical droplet. Cheilocystidia similar to pleurocystidia. Caulocystidia abundant, elongate-fusiform to tapered with rounded apex. Stipe flesh monomitic (not sarcodimitic); hyphae clamped. Basidiospores white in prints, thin-walled, unornamented.

Typus generis: *Rhizomarasmius pyrrhocephalus* (Berk.) R.H. Petersen, *comb. nov.* [**Basionym**: *Marasmius pyrrhocephalus* Berkeley. 1847. London J. Bot. 6: 316.]

Included species:

1. *Rhizomarasmius pyrrhocephalus*, *ibid.*

Holotype specimen: United States, Ohio, Wayne Co., Waynesville, 23.VIII.1844, coll. Thos. G. Lea (K)

= *Marasmius macrorhizus* Montagne. 1856. Syll. Gen. Sp. Cryptog., p. 142.
= *Marasmius longipes* Peck. 1873. Bull. Buffalo Soc. Nat. Sci. 1: 58. [*non M. longipes* Montagne, 1854. Ann. Nat. Sci. Bot. IV 1: 114]
≡ *Marasmius elongatipes* Peck. 1882. Bull. Buffalo Soc. Nat. Sci 4: 181 [*nom. nov.*]
= *Marasmius hirtipes* Clements. 1896. Bot. Surv. Nebraska 4: 21.[*non M. hirtipes* Spegazzini. 1898. Anales Mus. Nac. Hist. Nat., Buenos Aires 6: 112]
= *Marasmius morganianus* Sumstine. 1914. Mycologia 6: 35.

Commentary. - As pointed out by Petersen (1980), while most American specimens came to Berkeley through M.A. Curtis, an early batch was sent directly by Lea to Berkeley. Thus no isotype material is to be expected at FH *ex herbio Curtis.*

Desjardin (1989) examined type material of all species epithets listed above under *M. pyrrhocephalus* (except Montagne specimens), and Petersen (unpubl. data) re-examined the type specimen of *M. pyrrhocephalus* at K. Desjardin included specimens from Ontario (Canada), Illinois, Kansas, Massachusetts, Michigan, Minnesota, Nebraska, New York, North Carolina, Ohio, Pennsylvania, Tennessee, Vermont, and Virginia (United States) in his floristic monograph (Desjardin, 1989). Fresh specimens matched the type specimen well, and a full description of each is not needed here. Suffice to write that the pileipellis comprises sphaeropedunculate, often thick-walled cells and (on all material examined by RHP) lanceolate, usually thin-walled pileicystidia. Pleurocystidia and cheilocystidia are abundant, subcapitate to somewhat ten pin-shaped, caulocystidia are lanceolate and thick-walled, and basidiospores are ovoid to elongate-ovoid. Basidiomata of the species differ as follows: 1) pileus color is yellow-ochre to brownish yellow in *R. pyrrhocephalus* but cinereous to dull pale gray in *R. undatus*; 2) basidiospores of *R. pyrrhocephalus* are elongate-ovoid, those of *R. undatus* stouter and sublimoniform; and 3) the radicating stipe of *R. pyrrhocephalus* is found attached to buried hardwood twigs and branches, while that of *R. undatus* is usually found attached to buried old stems of *Pteridium aquilinum.* Ranges also seem mutually exclusive, with *R. pyrrhocephalus* throughout eastern North America and *R.*

undatus extending from Scandinavia to the Balkans and Caucasia. Finally, single-basidiospore isolates of the two species are sexually incompatible (data not shown).

2. ***Rhizomarasmius undatus*** (Berkeley) R.H. Petersen, *comb. nov.* [**Basionym**: *Agaricus undatus* Berkeley. 1836. English Flora 5: 51. (*non A. undatus* Fries. 1838. Epicr. p. 149)].

Neotype specimen [design. Antonin & Noordeloos, 1993]: Rabenhorst. Fungi Europaei Exsiccati. Klotzschii Herbarii vivi Mycologici Continuatio. Editio nova, series secunda. 1859-. No. 103. "Ad Upsaliam secus vias in pinetis Septbr. 1859. Leg. Th. M. Fries"

≡ *Marasmius undatus* (Berk.) Fries. 1849. Summa Veget. 2: 313.

≡ *Agaricus vertirugis* Cooke. 1871. Handbk. Brit. Fungi 1: 57, *nom. nov; nom. superfl.*, illegitimate.

= *Marasmius chordalis* Fries. 1838. Epicrisis, p. 383.

Illustrations: Jahn, H. (1961; with loose photograph); Moser & Jülich (1992: *sub Marasmius*, pl. 3; Phillips (1981: 67); Antonin & Noordeloos (1993: pl. 7); Gerhardt (1997: 193); Ryman & Holmåsen (1984: 331, as *Marasmius chordalis*).

Commentary. - Two impediments impinge on inclusion of *Marasmius undatus* in *Rhizomarasmius*: 1) taxonomic considerations; and 2) nomenclatural problems.

Taxonomy: Two questions: 1) are *M. undatus* and *M. chordalis* synonymous names; and 2) is/are these name(s) assignable to *Rhizomarasmius?*

At Kew, three specimens are candidates for lecto- or neotypification of *A. undatus* Berk. First, *ex herb.* Berkeley, Wolthorpe, North[hampton]s[hire], no date (topotype location, cf. *English Flora* 5: 51); 2) "Berkeley. *British Flora.* 1836-43. 9. *Ag undatus*, Berk[eley]," no location, no date; and 3) *ex herb.* Broome, King's Cliffe, Oct. 1858 [date too late for lectotype, but topotype area; cf. *Engl. Fl.* 5: 51]. Of these three, the first, while comprising three pressed, glued, poorly preserved basidiomata all attached to decayed fern parts, is the best material. Although most micromorphological characters can no longer be discerned, pileipellis elements (inflated sphaeropedunculate palisade plus sublanceolate pileicystidia) were observed, as well as characteristic basidiospores. There was no doubt that the specimens represented the common British use of the species name.

Antonin and Noordeloos (1993) chose a different direction. They designated as lectotype: Rabenhorst Fungi Europaei exsiccati no. 403, Great Britain, Batheaston, 1861, coll. C.E. Broome [K; isolectotype, PRM]. This choice surely provides better material for micromorphological examination. Of course, the specimen was not in Berkeley's hand when he described the taxon, and so must be a neotype, not a lectotype as designated by Antonin and Noordeloos, but otherwise, there is no reason to overthrow their choice.

Likewise, two specimens at Kew could serve as neotype for *M. chordalis* Fries: 1) labelled "M. chordalis – Upsaliae" in Fries's hand, *ex herb.* Broome (one pressed, glued basidiome); and 2) labelled "Heliomyces ?chordalis. Marasmius Epicr. Upsaliae" in

Fries's hand, *ex herb.* Berkeley (two pressed, glued basidiomata). Neither specimen is dated, so neither can serve as lectotype. Although micromorphological characters were hardly revivable, pileipellis elements, cheilocystidia and basidiospores were observed on both specimens, and were found to conform to Fries's original description and common usage of the name (cf. Ryman and Holmåsen, 1984). If a neotype (rather than a lectotype, which would have had to have been in Fries's possession at the time of his original description) must be designated, a Fries specimen is not necessary. Indeed, the two Fries specimens at Kew are only enough to provide a rough definition of Fries's use of the name. These characters, however, can be matched to a more modern, better preserved, more copious specimen. For this purpose, I designate the following specimen as **neotype for *M. chordalis* Fries**: Fungi Exsiccati Suecici, S. Lundell & J. Nannfeldt. No. 2862. Sweden, Uppland, Fasterna Parish, N. Varleda, 14.VIII.61. Assumedly all distributions of this number are equally isoneotypes. Lundell stated on the label: "[H.] Jahn (Westfäl. Pilzbr. 3: 33-40. 1961) gives an excellent, illustrated account of this species based on this very collection" (an added advantage for this specimen).

The specimen supports complete macro- and micromorphological analysis. All structures not only match those of the Fries specimens (at K, see above) but also those visible on the ex herb. Berkeley specimen of *A. undatus* at Kew. It is possible, therefore, to accept this species as belonging in *Rhizomarasmius.*

Nomenclature: Four species epithets frame the nomenclatural problem: *Agaricus* (*Collybia*) *undatus* Berk., *Marasmius chordalis* Fries, *Agaricus* (*Clitopilus*) *undatus* Fries, and *Collybia vertirugis* Cooke.

Berkeley proposed his *A. undatus* in *English Flora* (1836, vol. 5, edited by W.J. Hooker, p. 51), published in April, 1836, according to Taxonomic Literature II, based on notice by London Medical Gazette 18: 176-178, dated 30 April 1836.

Fries proposed his *Marasmius chordalis* (subg. *Mycena*, sect. *Chordales*) in *Epicrisis Systematis Mycologicum*, p. 383. The title page of *Epicrisis* states its publication as 1836-1838 (copy at Kew; Italian reprint, etc.). In Fries's introduction to *Hymenomycetum Suecicae* (p. x), Fries gave the date of publication of *Epicrisis* as June, 1838 (as noted by R.W.G. Dennis inside Kew's copy of *Epicrisis*). Stafleu and Cowan (TLII) stated that there was no evidence that *Epicrisis* was published in parts, and was noted in *Flora* 22: 16, dated 7.I.1839, and received by Hinrichs in Leipzig between 10-16.III.1839. If all this is true, *M. chordalis* dates from 1838, not 1836.

Krok (1925, *Biblioth. Bot. Suecana*, p. 208) listed *Epicrisis* "*sectio prior*" as 1836, but "*sectio secunda*" as 1838. So the possibility exists that some limited edition of *Epicrisis* was available in 1836. Nonetheless, *M. chordalis* appears on p. 383, clearly in the second half of the volume, and thus dating from 1838, regardless of the date of "*sectio prior.*" I can add the following data supporting Krok's report: 1) on page 240, the last listed species of *Psathyrella* is abbreviated by "*A*[*garicus*]," while starting with page 241, subsequent species are abbreviated with the name of thesegregate genus (i.e. "*M*" for *Marasmius*); 2) on page 239, the header is in Italics (i.e. *Psathyrella*), while starting on page 241, headers are in Roman type; 3) on page 238, the header is

"Agaricus," while starting on page 240 it is Agaricini. It would appear, therefore, that *Epicrisis* was physically divided into two parts. This may merely reflect that part one was printed (perhaps in 1836) but not bound or distributed until part two was struck from the press (in 1838), which would agree with Krok's, report but also with the possibility that the publication date for the combined volume was 1838, as reported by Fries.

In *Epicrisis*, p. 149, Fries proposed *Agaricus undatus* in subg. *Clitopilus*. This page is clearly in the first part of the volume, and therefore could have appeared in 1836, and perhaps may claim priority (in *Agaricus*) over Berkeley's species epithet. I have chosen to rely on TLII (publication date for *Epicrisis* as 1838) and accept Berkeley's species epithet as prior. Moreover, even if Fries's *undatus* claimed priority in *Agaricus*, once transferred to *Clitopilus* it gave up priority against Berkeley's *undatus* in *Marasmius*, a transfer proposed by Fries himself in 1849.

Finally, Cooke (Handbk. Brit. Fungi, vol. 1, 1871) apparently assumed that Fries's *A. undatus* was prior to Berkeley's, and substituted *A.* (*Collybia*) *vertirugis* for Berkeley's epithet *undatus*. If the dates presented above are correct, Cooke's substitution was unnecessary and created *a nomen superfluum*, an illegitimate name under the ICBN.

I conclude that Berkeley's combination *Agaricus undatus* is the correct name for the taxon, which is assignable to *Rhizomarasmius*.

3. ***Other included species***: - A third species, *Marasmius mediterranea* (Pacioni & Lalli) Bas & Robich, carefully redescribed by Bas and Robich (1988) as a *Flammulina*, probably belongs in *Rhizomarasmius*. Likewise, Corner's (1996) description of Bornean basidiomata under *Xerula longipes* would seem to fit *Rhizomarasmius*. Until more data on these taxa are gathered, formal transfer is postponed.

DISCUSSION

Circumscription of the Xerulaceae. - Proposal of a new genus name, especially in this case, should be accompanied by the rationale for both its distinction and its placement among other agaric names. Over the past decade, this laboratory has investigated mating systems and sexual compatibility patterns in several genera placed in the Xerulaceae by Redhead (1987): *Xerula* (Petersen and Methven, 1994), *Oudemansiella* (Petersen and Halling, 1993), *Strobilurus* (Petersen, 1995), affording some familiarity with these morphogenera. This family name, however, was coined by Jülich (1981) with *Lampteromyces*, *Oudemansiella*, and *Xerula* as "examples" (not necessarily barring other genera). In at least two phylogenetic reconstructions *Lampteromyces* is found in a clade with *Pleurotus* and *Hohenbuehlia* (25s rDNA, Thorn, pers. comm.) or in a clade with *Omphalotus* and *Neonothopanus* (as *Nothopanus*; 28s rDNA, Binder, pers. comm.; see Petersen and Krisai-Greilhuber, 1999), and therefore can be dismissed from further consideration here.

In the opinion of some authors, *Rhodotus* should be taxonomically included with Jülich's exemplary genera [based on inclusion in a xerulaceous clade (25s rDNA, Montcalvo *et al.*, 2000)], in which case the family name Rhodotaceae Kühner (1980) is prior. For both Kühner and Jülich, the Rhodotaceae was monotypic.

Jülich's (1981: 284) diagnosis of the Rhodotaceae should be consulted. His note (page 71) about placement of *Rhodotus* reads: "Isolated position, perhaps related to the Hydnodontales." Nonetheless, *Rhodotus* represents pileate-stipitate agarics, and thus its inclusion within the Xerulaceae would not drastically distort the original circumscription of that family.

Still further, *Physalacria* (at least some species) might be included based on phylogenetic reconstruction (25s rDNA, Montcalvo, pers. comm.). In this case, the taxonomically inclusive family name would be Physalacriaceae Corner (1970). Corner included the genera *Hormomitaria* and *Pseudotyphula* in the Physalacriaceae, but their possible inclusion in the xerulaceous complex remains untested.

Especially in this latter case, Jülich's (1981) circumscription of the Xerulaceae would require significant emendation. In the following recapitulation of Jülich's family circumscription, words in Italics would require change or deletion if *Physalacria* were included. "Basidiocarp annual, *agaricoid*, stipitate, *lamellate*, *with collybioid habit*, pale to brown, dry or viscid to glutinous, a ring present or absent. *Lamellae somewhat thick, broad, with regular trama.* Context white, inamyloid. Hyphal system monomitic, in some species ± sarcodimitic. Hyphae hyaline, cylindrical, very narrow to large, thin- to slightly thick-walled in the subhymenium, somewhat to distinctly thick-walled in the stipe, smooth, usually with clamps. Cystidia large, hyaline, broad, smooth, thin- to somewhat thick-walled, smooth, somewhat guttulate. Basidia *large*, hyaline, clavate, smooth, thin-walled, guttulate, with a basal clamp, (2-) 4-spored. Spore-print white. Spores *large*, hyaline to yellow, globose to *broadly* ellipsoid, smooth to rough or minutely warted, *slightly to distinctly thick-walled*, guttulate, inamyloid." Jülich (1981: 70, under Tricholomatales): "Xerulaceae. *Agaricoid* family, shares a common origin with the Collybiaceae, differs in its *large basidia and large, thick-walled spores*. Is probably related to the secotioid family Gigaspermaceae."

Inclusion of *Physalacria*, therefore, extends the family from strictly agaricoid to reduced forms lacking pileus, lamellae, pileipellis structure, etc. While perhaps justified from a phylogenetic viewpoint, such inclusion would drastically distort the intent of the Xerulaceae and/or the Rhodotaceae. Larger than the problem of finding the proper circumscription for this family, the general tension between morphological similarity versus molecular relatedness and the influence of the latter on ranking and naming processes is accentuated. Another such example of discordant morphs can be seen when coralloid fungi (*Ramaria, Lentaria*) and cantharelloid forms (*Gomphus, Clavariadelphus*) find relatives in the gasteromycetes (*Geastrum, Sphaerobolus, Pseudocolus*; Pine et al, 1999). Whether such divergent forms should be sheltered under a single family name can be debated.

More recently, Redhead (1987a) emphasized presence of sarcodimitic basidiome tissues (most often in the stipe medullary region) in his circumscription of an emended Xerulaceae. Large numbers of species were surveyed for this feature, and because *Rhodotus* (and *Flammulina*) lacked sarcodimitic tissues, they were not included in Redhead's sense of the family. Conversely, 25 genera were included, adding considerably to Jülich's examples. More recently, however, Redhead and Norvell (1993) found sarcodimitic hyphal construction in fungi well outside the Xerulaceae, and questioned this character as diagnostic. Likewise, tissues quite similar to classic sarcodimitic construction are encountered in *Clavaria s. str.* (Petersen, 1968, as *Clavulinopsis*), not closely related to the Xerulaceae (see Pine, et al., 1999).

Although lack of sarcodimitic hyphal construction would seem to disqualify *Rhizomaramius* from inclusion in the Xerulaceae *sensu* Redhead (not *sensu* Jülich), several other character suites (including similarities in DNA sequences) imply a close relationship. Two are of primary importance: 1) structure of the pileipellis; and 2) shape and prominence of pleuro- and cheilocystidia. Pileipellis structure for members of the Xerulaceae has been described by the following: Bas (1983) and Redhead and Petersen (1999) for *Flammulina*; Redhead (1987b) for *Xerula*; Redhead (1980) for *Strobilurus*; and I have examined this tissue in three species of *Pseudohiatula* (unpubl. data). In all cases, the norm is a hymeniiform layer of clavate to sphaeropedunculate, inflated hyphal tips interspersed with long, tapering pileicystidia. Only in some species (i.e. *Flammulina velutipes*) is this arrangement disturbed.

Redhead et al. (2000) furnished a detailed discussion of the importance of bilateral lamellar trama in the separation of *Pseudohiatula* from *Flammulina*. They concluded that while Singer had made bilateral gill trama a leading generic character for *Pseudohiatula*, this tissue arrangement was also found in some species of *Flammulina*. This forced separation of these two genera on only the basis of amyloid spores in the type species of *Pseudohiatula*, but inamyloid spores in *Flammulina*. In this way, what had been considered a diagnostic character (i.e. bilateral trama) now became spread across two genera. Perhaps pileipellis arrangement and cystidial shape and protrusion from the hymenium furnish the best clues through which to diagnose this family. Simultaneously, if Donk's (1971) philosophy of taxonomy *par enchainement* is followed to its conclusion, there may not be any single unifying character found in every taxon of the family, and relationships may yet rely on base-pair differences in DNA sequences.

Of subordinate taxonomic significance are stipe characters. First; a radicating stipe is already known in the Xerulaceae (i.e. *Xerula*, *Flammulina*, modified in *Strobilurus*), but not the norm in *Marasmius*. Second; most of the genera cited above include caulocystidia as part of their diagnosis. Such caulocystidia may vary in shape and abundance, but in most cases the stipe is ornamented rather than glabrous. In *Hydropus*, caulocystidia resemble pleurocystidia and usually are glandular. Third; field experience suggests that a typical stipe in this family is apically concolorous with the lamellae (i.e. white or ivory colored), but within a few millimeters becomes dull ochraceous orange, and again in a few millimeters becomes significantly darker (in *Rhizomarasmius* black, in *Strobilurus* russet brown; in *Flammulina* sooty brown, sometimes with yellow-olive tints; in *Pseudohiatula* brown to olive-brown).

Corner (1966) first included *Trogia* as part of the cantharelloid fungi, a macromorphological judgement, later (Corner, 1991) gathering taxa from several scattered genera into *Trogia* based on presence of sarcodimitic tissue, an anatomical feature, and little else. *Xerula* was not merged into *Trogia* in spite of sarcodimitic stipe tissues.

Still later (Corner, 1996) subacerose basidiolar shape was used to diagnose yet another large generic complex, but *Xerula* was not included in that group either. His exposition on *Xerula longipes* (Corner, 1996), the sole species of *Xerula* included in that publication, however, was based on very limited collections (five collections, totaling six basidiomata) from Mt. Kinabalu, Borneo, even though this epithet was proposed to represent European basidiomata. Desjardin and Horak (1997) rejected Corner's more inclusive taxonomy, preferring to use segregate names along the lines of Singer (1986).

Inclusion of *Rhodotus* as an element within an expanded Xerulaceae introduces some new characters: 1) "bilateral [lamellar] trama;" 2) absence of hymenial cystidia; 3) pinkish-ochraceous spore print; and 4) gelatinized pileus context. Recent papers on *Flammulina* (Redhead, et al. 1998, 2000) have shown that several species produce lamellar tramae in which the subhymenium is gelatinized but the mediostratum is not, thus producing a bilateral construction. Some species of *Xerula* also exhibit a gelatinizing lamellar trama. Although *Flammulina* does not exhibit sarco-dimitic tissues, most other micromorphological characters match those of the family, so bilateral lamellar trama would extend into at least three genera. Lack of hymenial cystidia, for me, is a more serious matter, for all accepted genera of the family (and those proposed below as additions) exhibit characteristic prominent hymenial cystidia. Spore print color cannot be regarded as definitive considering the variation in this character in other families of agarics. Gelatinized pileus trama is also found in *Flammulina*, where it seems to accompany bilateral lamellar trama arrangement.

To define the Xerulaceae exclusively on the presence of sarcodimitic tissues is "one-character taxonomy." There are several other morphological character fields which may be informative: presence of characteristic hymenial cystidia and pileipellis arrangement are two. Close relationships as depicted in molecular phylogenetic reconstructions provide additional strong evidence. Using these characters, *Flammulina* (see Petersen et al., 1999), at least some species of *Pseudohiatula*, and *Rhizomarasmius* may be included in a further emended Xerulaceae. Molecular evidence also supports inclusion of *Rhodotus* (Montcalvo et al., 2000).

The species of *Rhizomaramius* traditionally found their place in *Marasmius* sect. *Globulares*, in which the pileipellis consists of a hymeniiform layer of unornamented, inflated hyphal tips. But prominent pleuro- and pileicystidia and radicating stipe are discordant in this group, and removal of *M. pyrrhocephalus* and *M. undatus* (and perhaps other species equally discordant) leaves sect. *Globulares* somewhat less heterogeneous.

Mating systems. - Arnold (1935) reported that *M. elongatipes* (= *R. pyrrhocephalus*) was tetrapolar, and Gordon and Petersen (1991) confirmed this using a North Carolina collection. This paper reports that *Marasmius undatus* (≡ *Rhizomarasmius undatus*) is also tetrapolar (data not shown). These data conform to the mating system usually found in the Xerulaceae, but also in several sections of *Marasmius* and other genera of the Tricholomataceae. Tetrapolarity, therefore, is not diagnostic for the species or the genus *Rhizomarasmius*.

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A NEW DIAGNOSTIC CHARACTER FOR THE GENUS COLLYBIA (AGARICALES)

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ABSTRACT. The structure of the cortex of the sclerotium is indicated as a diagnostic character for the *Collybia* species with small fruit bodies - those of the *Collybia* sensu stricto e.g. *C. cookei, C. racemosa,* and *C. tuberosa.* This feature permits faster and easier identification of these taxa, in both fresh and dry herbarium material.

Key words. Basidiomycetes, Agaricales, Tricholomataceae, *Collybia*, sclerotium, sclerotial surface, diagnostic character.

INTRODUCTION

Each new feature facilitating faster and easier identification of a given taxon is noteworthy. This is particularly important in the identification of fungi, as they are numerous, extremely variable, and may seem similar or even identical to those who are not experts and have not seen their variability. This character, has not yet been taken into consideration in the identification of the species of *Collybia* genus (Agaricales, Tricholomataceae) is the formation of the cortex of the sclerotium. It is used, for example, in the identification of the species of *Typhula* genus (Typhulaceae, Cantharellales, Corner 1950).

MATERIAL AND METHODS

Within the genus *Collybia* (Fr.) Staude, s. l. (nom. cons.) there is a group of species which have small fruit bodies (pileus diameter between 0.3 - 1.5 cm) that are white or almost white in colour, and grow on the remains of much decayed agarics or on litter - usually from the sclerotium. They are sometimes classified as a separate genus - *Microcollybia* (Lenox 1979), *Collybia* s. str. (Antonín & Noordeloos 1997, Antonín, Halling, Noordeloos 1997) or treated as a subgenus within the *Collybia* genus (others authors e.g. Halling 1983, Singer 1986). These are *C. cirrhata* (Pers.) Quél. (not arising from a sclerotium), *C. cookei* (Bres.) Arnold, *C. racemosa* (Pers.: Fr.) Quél., and *C. tuberosa* (Bull.: Fr.) Kumm. The identification of these species, particularly in abundant dry material, is troublesome and time-consuming. It involves the preparing and viewing of many slides under a microscope, and accurate measuring of spores (the differences in their lengths being small), to confirm the presence or absence of pileocystidia and caulocystidia. By comparing the cortex of the sclerotium, identification could be made markedly easier. Even a not very thinly crushed preparation, made of the surface of dry or fresh sclerotium (e.g. in a 3% KOH or NaOH and phloxin), ensures the error-free identification of these taxa.

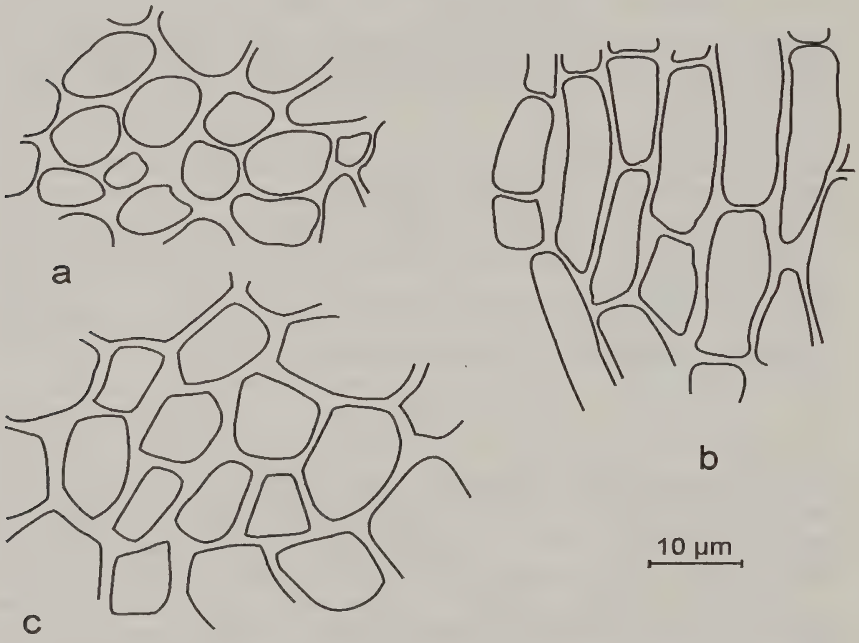

Fig. 1. Surface views of sclerotia: a - *Collybia cookei* KRAM, F-27665, South Poland, the Niepołomice Forest, *Pino-Quercetum*, 145 forest section, 6 Sept. 1978; b - *Collybia tuberosa* KRAM, F-25997, South Poland, the Niepołomice Forest, *Tilio-Carpinetum/Pino-Quercetum*, 137 forest section, 9 Oct. 1976; c - *Collybia racemosa* KRA, Western Carpathians, the Pieniny National Park, the Mała Dolina valley, on moss in mixed young stand, 31 Aug. 1967.

RESULTS

During many years of field studies, while collecting and identifying fungi, particularly those of Tricholomataceae, the author has used the structure of the cortex of the sclerotium for identification of small white specimens of the *Collybia* genus. In most cases turned out to be *C. cirrhata* (without sclerotium), *C. cookei,* or *C. tuberosa*. Under the microscope the hyphae of the sclerotium *C. cookei* appear round whereas those of *C. tuberosa* appear elongated (Fig. 1 a, b). She has never collected *C. racemosa* beiself. In Poland, there are several specimens of this fungus collected from one site in the Pieniny Mts. (the Carpathians) by B. Gumińska of the Jagiellonian University. The hyphae of the cortex of the sclerotium may, at first glance seem similar to those of *C. cookei*, but on comparison it can be seen that the hyphae of the sclerotium cortex in *C. racemosa* are markedly angular (Fig. 1c) and not round as in *C. cookei*. Additionally, the stalk in *C. racemosa* is distinctly racemose (with short side branches), a feature that also helps in distinguishing this species from other small whitish species of the *Collybia* genus.

Collybia (Fr.) Staude s. str.

Basidiocarps usually arising from a sclerotium, growing on decaying fungi and on soil or humus. Cap small, whitish, membranous 0.3-1.5 cm, stem 1-5 x 0.1 cm.

Key to Species.

A. Pileus small, white, membranous, occuring on blackened fungus remains, rarely on humus, not arising from a sclerotium .... *C. cirrhata*

A. Basidiocarps arising from sclerotium ....**B**
B. Hyphae of the sclerotium surface thick-walled, elongate .... *C. tuberosa*
B. Hyphae of the sclerotium surface thick-walled, round or angular .... **C**

C. Hyphae round .... *C. cookei*
C. Hyphae angular, stipe racemose .... *C. racemosa*

Acknowledgenents

The author wishes to thank Professor B. Gumińska of the Jagiellonian University for making specimens of *Collybia racemosa* available, and Dr. V. Antonín of the Moravian Museum for his critical comments on the manuscript.

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TAXONOMY OF FUSARIUM: FUSARIUM ARMENIACUM STAT & COMB. NOV.

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ABSTRACT

Fusarium acuminatum subsp. *armeniacum*, is raised to species rank becoming *F. armeniacum* stat. nov. This revision is made on the basis of comparative data from studies on the toxicology and karyotype of the two subspecies of *F. acuminatum*, subsp. *acuminatum* and subsp. *armeniacum* and studies on their genetic affinity using isozyme and RAPD analysis. As a consequence *F. acuminatum subsp. acuminatum* is accorded species status.

Fusarium acuminatum subsp. *armeniacum* Forbes, Windels & Burgess was first recognized as a distinct entity in Minnesota, USA (Kommedahl, Windels and Stucker 1979, Windels, unpublished data), and was later recovered in Australia (Forbes 1984, Burgess, Liddell and Summerell 1988, Burgess *et al.* 1993) and South Africa (Marasas *et al.* 1988, Rabie *et al.* 1986, Van Wyk *et al.* 1987). It was accorded the rank of a subspecies of *F. acuminatum* rather than a distinct species because the shape of the macroconidia did not differ significantly from *F. acuminatum sensu stricto* and the two subspecies "intergraded with respect to morphological and ecological criteria and some physiological characteristics".

Evidence from subsequent studies on the toxicology of the two subspecies and on their genetic relationships support a revision of their taxonomic status.

Fusarium armeniacum (Forbes *et al.)* Burgess et Summerell, stat. & comb. nov.
Basionym: *Fusarium acuminatum* subsp. *armeniacum* Forbes *et al. Mycologia* 85: 119-124 (1993). Holotype DAR 67507.

Since the original formal description of *F. armeniacum* as a subspecies, Nagy and Hornok (1994), using pulse-field electrophoresis, showed that the chromosome number and size of *F. armeniacum* differs from *F. acuminatum.* They observed differences in chromosome number and size between the subspecies. Considerable differences exist in the toxin producing ability of cultures of the two species to produce toxic substances (Logrieco *et al.* 1992). Rabie *et al.* (1986) had also noted that some atypical isolates of *F. acuminatum*(i.e. *F. armeniacum*) produced high levels of T-2 toxin. *F. armeniacum* produces A type trichothecenes, whereas these compounds are not found in *F. acuminatum* (Wing *et al.* 1993). Nagy and Hornock (1994) developed probes for trichodiene synthase gene Tox5 and obtained hybridisation signals only in cultures of *F. armeniacum* indicating that *F. acuminatum* is incapable of producing trichothecenes.

Altomare *et al.* (1997) used isozyme and RAPD analyses to study relationships among *F. acuminatum* (both subspecies), *F. sporotrichioides* Sherb. and *F. tricinctum* (Corda) Sacc., showing that *F. acuminatum* was closely related to *F. tricinctum* and *F. armeniacum* to *F. sporotrichioides. F. sporotrichioides* also produces high levels of trichothecenes. Degenerate cultures of *F. armeniacum* usually retain the ability to produces trichothecenes according to the studies reported by Wing *et al.* (1995).

Subsequent biogeographic data by the authors in Australia (L.W. Burgess and B.A. Summerell, unpublished data) have shown that *F. acuminatum* is more common in the temperate areas of south eastern Australia in grassland and cultivated soils, whilst *F. armeniacum* has most commonly been isolated from sub-tropical and tropical soils. Sangalang *et al.* (1995) have shown that *F. acuminatum* survives poorly at higher temperatures and presumably this is one reason why the fungus is not found in regions where temperatures are higher. Further investigations of the ecology of this species are warranted particularly given its potential for producing high levels of trichothecenes.

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ACREMONIUM NEOCALEDONIAE, A NEW SPECIES FROM WOOD IN THE SOUTHWESTERN LAGOON OF NEW CALEDONIA

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Abstract. *Acremonium neocaledoniae* Roquebert & Dupont, a new species of *Acremonium* isolated from drifting wood in southwestern lagoon in New Caledonia, is described. It is readily distinguished from related species of the genus by the size and shape of conidia, confirmed by molecular data (18S rDNA) and by the production of a new cytotoxic metabolite sesquiterpene trichothecene, verrol 4-acetate.

Résumé. *Acremonium neocaledoniae* Roquebert & Dupont, est une nouvelle espèce d'*Acremonium* isolée d'un morceau de bois dérivant dans le lagon sud- ouest de Nouvelle Calédonie. Elle diffère des autres espèces du genre par la morphologie (grande taille et forme des spores) confirmée par le profil moléculaire (18S rDNA) et par la production d'un nouveau trichothécène sesquiterpénique cytotoxique, le verrol 4-acetate.

Key words: *Acremonium neocaledoniae* n. sp., Hyphomycete.

The work described in this paper was originated from a study of fungi isolated from wood submerged in the southwestern lagoon of New Caledonia, for screening of bioactive metabolites.

Among species analysed for active metabolites, one of them was selected for its production of a new cytotoxic trichothecene sesquiterpene, verrol 4-acetate, among with known macrocyclic trichothecenes mycotoxins and medicinal styrylpyrones (Laurent *et al.*, 2000).

Identification of this fungus poorly sporulating on malt agar or PDA at 25°C was difficult; but its relatively abundant conidiogenesis on sea water medium (GYA, Kohlmeyer and Kohlmeyer, 1979) and the marine nature of its original environment first indicate the possibility to be *Monosporium maritimum* Sutherland (1916). But solitary conidia of *M. maritimum* do not correspond to the conidial arrangment of our strain and Kohlmeyer and Kohlmeyer (1979) consider *M. maritimum* as a *nomen dubium.*

Nevertheless, aspect of the culture, morphology of the thallus and conidiogenesis allow us to identify it as belonging to the genus *Acremonium. Acremonium hypholomatis* (Boedijn) Hawksworth (Hawksworth, 1972) isolated from water culture of decaying leaves collected in New Guinea, stream near Garaina, may be close but conidia have not the same shape and size and no more material (herbarium or living culture) is available to compare them. Size, shape and groupment of conidia make it different from other known species of the genus and indicate a new taxon.

Simultaneously with macro- and micromorphological studies, and to confirm the identification, the partial 18S rDNA sequence was obtained and compared with those of 15 taxa having anamorphs currently classified in *Acremonium*, kindly communicated by A. E. Glenn (Glenn *et al.*, 1996), or others from Gene Bank.

MATERIALS AND METHODS

Biological material

The fungus was isolated from drifting wood collected intertidally in Gadgi bay on the western coast of New Caledonia, about 20 km north of Noumea, in February 1997. The piece of this undeterminated wood was placed in a moist chamber for some days (D. Laurent, IRD, Nouméa) allowing the isolation of the fungus on marine agar medium: potato extract 125 g, glucose 10 g, agar 15 g, marine water 1 litre, with added penicillin G 1MU and colimycin 1MU. For preservation and identification 2 media were used: MA 2% and GYA (glucose 1 g, yeast extract 0.1g, agar 18 g, sea water 1 litre). Incubation was performed at 25°C.

DNA extraction, amplification and sequencing methods

Genomic DNA was extracted from fresh mycelium grown on MA for 10 days using a CTAB micropreparation method (Rogers and Blendich 1985).

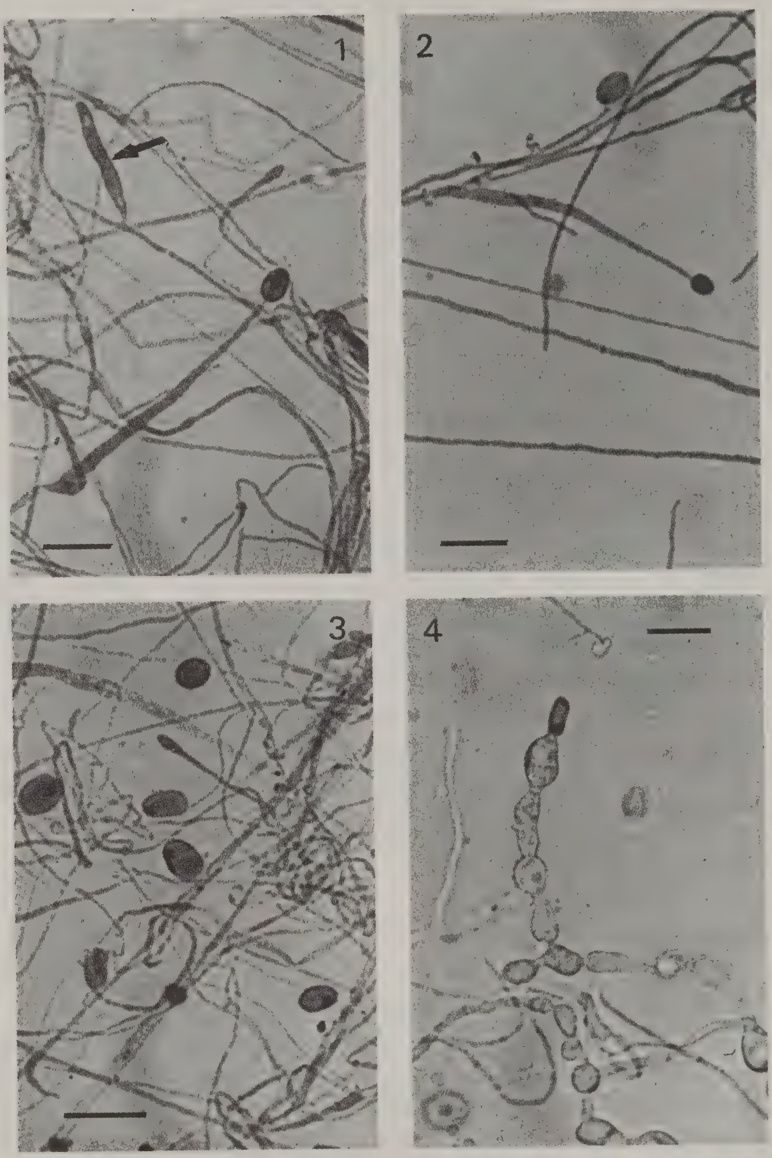
The oligonucleotide primer set NS1 and NS4 (White *et al.* 1990) was used to amplify the 5' end of the 18S rDNA. The PCR reactions were done in a final volume of 50 μL containing: 25 μL of a 100 fold dilution of the genomic DNA, 1.25 units of AmpliTaq DNA polymerase (Perkin Elmer), 5 μL of 10 X Taq DNA Polymerase buffer (10 mM Tris HCl pH 9.0, 50 mM KCl, 1.5 mM $MgCl_2$, 0.1% Triton X100, 0.2 mg/mL BSA), 5 μL of 50% glycerol, 2 μL of 5 mM dNTPs (Eurogentec, Seraing, Belgium) and 2 μL of each 10 μM primer. Amplifications were performed on a Perkin Elmer Cetus thermal cycler model 2400 using an initial denaturation of 94°C for 8 min, followed by 30 cycles of 94°C for 20 s, 45°C for 20 s and 72°C for 25 s. A final extension step of 8 min at 72°C was included.

The 18S rDNA region was sequenced on both strands using the ABI PRISM^{TM} Dye Terminator Cycle Sequencing Ready Reaction Kit (Applied Biosystems) with the amplification primer NS1 and internal primers designed for this study (ESGS Groupe CYBERGENE, Evry, France) NS1.1 (CAGCAGCCGCGGTAATTC), NS4bis1 (TCAGCCTTGCGACCATAC) and NS4bis2 (CTGGAATTACCGCGGCTGC). Sequencing assays were analyzed on an automated DNA Sequencer ABI PRISM 377 (Applied BioSystems). The nucleotide sequence (GenBank number: AF217194) was aligned manually together with other *Acremonium* sequences (Glenn *et al.*, 1996) of which the alignment was kindly provided by the author. Maximum parsimony analysis was realized using PAUP v. 3.1.1 (Swofford, 1993).

RESULTS

Cultural aspect

On marine medium (GYA) as well as on malt agar 2% (MA) the fungus is slow growing (2.8 cm in 20 days at 25°C); on GYA colonies are white to clear pinkish, slightly velutinate to floccose at the center, hyaline in the advancing zone, reverse uncolored to cinnamon in the center. On MA, colonies light beige, nutmeg in the center, plicated and dense, velutinate at the periphery, reverse beige, light cinnamon in the center.



Figs. 1, 2 and 3. Solitary phialides and conidia on GYA medium. Arrow indicates characteristic sterile mycelial proliferation which never secedes. Fig. 4. Moniliform mycelium on MA. Bar = 16.5 μm.

Microscopical characteristics

On MA, hyaline mycelium, 2.5 µm wide partially enlarged and moniliform 5.5-6.5 µm diameter (Fig. 4) in the older parts of the colony. Conidia produced later, very few in number, irregular in shape but more or less subglobose to ellipsoidal and sometimes slightly constricted in the midle.

On marine medium (GYA) mycelium hyaline, septate, 2.5 µm wide. Some hyphae inflated at the apex or lateraly in 22.5-30 x 3.7-5.6 µm cylindrical formations which never secede (Fig. 4)

Conidia after 10 days of fungal incubation grouped by 5 to 10, alternate, at the apex of conidiogenous cells, clearly separated one from another, hyaline, smooth, rounded ellipsoid, with a truncate base, 7.5-11.5 x 5.6-7.5 µm, most 9.5 x 6.5 µm (Fig.5). Conidiogenous cells phialidic, solitary, erect, orthotropically disposed along the fertile hyphae, 50-75 µm large, 3.7-4 µm wide, tapering to the apex (1.5 µm), with a small visible collarette, chromophilic at the base, with a basal septum (10 µm from the base) (Fig.1, 2 and 5).

Molecular analysis

1092 nucleotides of the 5' end of the 18S rDNA gene of the new taxon presented in this paper were sequenced and aligned unambiguously with the other *Acremonium* sequences previously studied by Glenn *et al.* (1996). Heuristic search based on the reduced dataset selected by Glenn *et al.* (Fig. 2 and 3 of their paper), produced a unique parcimonious tree of 535 steps (CI: 0.641; RI: 0.726; RC: 0.466). The basal position of *Acremonium neocaledoniae* within the *Acremonium alternatum* cluster in the Hypocreales is poorly supported by bootstrap analysis. However, its position within the larger clade encompassing species affiliated to Hypocreales and Clavicipitales (*Epichloe* and their anamorphs classified in *Acremonium* sect. *albolanosa*) is supported with a 83% bootstrap value. The pourcentage of differences observed between *A. neocaledoniae* and the representative species of this clade range from 1.7% with *A. alternatum* (Hypocreales), to 2.2% with *Neotyphodium coenophialum* (Clavicipitales) and 3.2% with *A. strictum* (Hypocreales). A larger divergence was observed with *Acremonium* species of other ascomycetous affinities, 5.3% with *A. alabamense* (Sordariales) and 6.8% with *A. furcatum* (Microascales).

Acremonium neocaledoniae Roquebert & Dupont sp.nov.

Coloniae lente crescentes, velutinae vel floccosae, marginibus plerumque submersis, hyalinae dein pallide roseae, reverso pallido centro cinnamomeo. Hyphae hyalinae, septateae 2,5 µm crassae. In agaro malto hyphae moniliformes, 6 µm crassae, numerosae, in coloniae centro productae. In GYA phialides plerumque simplices, basi septatae et modice chromophilae, 50-75 x 3.5-4 µm, apice collari brevi terminato. Conidia alternata connexa,

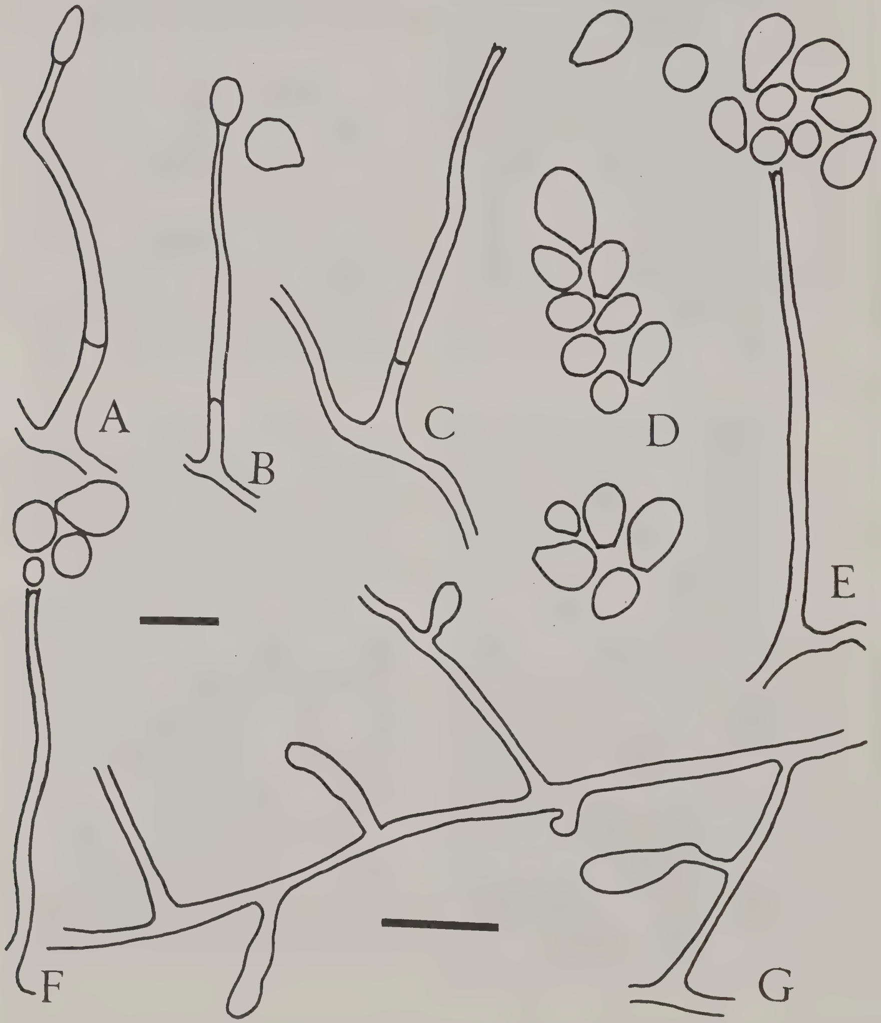


Fig. 5. Phialides and conidia, bar = 10µm. G: mycelial sterile proliferations, bar = 25µm.

hyalina, aseptata, globosa ellipsoidea, basi attenuate et truncata, 7.5-11.5 x 5.6-7.5 μm, plerumque 9.5 x 6.5 μm.
Holotypus: LCP 98 4255.
Ex ligno in aqua maritima immerso, Nova Caledonia Gadgi sinu, 1997. D. Laurent collegit.

Acremonium neocaledoniae Roquebert & Dupont sp.nov.

Colonies slow growing, white to clear pinkish on GYA, light beige to nutmeg on MA, reverse beige to cinnamon at the center. Hyaline mycelium, 2.5 μm wide with inflated cylindrical sterile formations 25- 30 x 3.7-5.6 μm. Phialides solitary (50-75 x 3.5-4 μm) tapering toward the apex with a small visible collarette. Conidia hyaline rounded ellipsoid, attenuated and truncated at the base 7.5-11.5 x 5.6-7.5 μm, most 9.5 x 6.5 μm.
Holotype: LCP 98 4255.
On undeterminated wood, drifting in sea water of southwestern lagoon, Gadgi bay, New Caledonia 1997. D. Laurent coll.

ADDITIONAL REMARKS:
18S rDNA nucleotide sequence deposited at GenBank number AF 217194.
New sesquiterpene trichothecene: verrol 4-acetate produced (Laurent *et al.*, 2000).

CONCLUSION

Identification of taxa poorly sporulating on standard media and with weakly differenciated morphology is not easy by using classical methods of observation. In the present study conjugaison of analytical methods of characterisation including morphology, molecular data and metabolite production allow to confirm the identity of the new species. First, the 18S rDNA sequence analysis placed the strain described in this study within the group of *Acremonium* species showing affinities with the Hypocreales and considered as the « true *Acremonium* » since it includes the type species of the genus, *A. alternatum*. More, the new species *A. neocaledoniae* produces a new cytotoxic sesquiterpene trichothecene verrol 4-acetate (Laurent *et al.*, 2000). Convergently many Hypocreales such as *Fusarium* (Miller *et al.*, 1991), *Trichothecium* and *Spicellum* (Seifert *et al.*, 1997) are known to produce trichothecenes as does *A. neocaledoniae.*

As molecular data are more and more numerous and easily available on database we can hope that in a near future morphological data will be regularly completed by molecular profiles to support morphological identifications of fungi, to compare them with other taxa and avoid misidentification and erroneous creations.

We wish to thank Dr G.L. Hennebert for his constructive review of the manuscript and Dr A. E. Glenn who kindly provide the aligned sequences of *Acremonium.* We are grateful to A. Berthelot and M. Dumont for their help with illustrations.

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BASIDIOMYCETES APHYLLOPHORALES
DE L'ILE DE LA REUNION
XXI- SUITE

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Abstract : Eleven families are evoked (see key words) and nine new species are created : *Boreostereum borbonicum, Boidinia dendrophysata, Megalocystidium gloeocapitulatum, Peniophora borbonica* and *dipyrenosperma, Sphaerobasidium gloeocystidiatum, Aphanobasidium acanthophoenicis* and *bisterigmaticum, Xenasma longicystidiatum.*

Keywords : *Boreostereaceae, Ceratobasidiaceae, Cystostereaceae, Dacryobolaceae, Gloeocystidiellaceae, Gloiotheleaceae, Lachnocladiaceae, Peniophoraceae, Repetobasidiaceae, Vuilleminiaceae* and *Xenasmataceae*. Island of Reunion.

Nous allons apporter des données sur des genres non traités précédemment, mais aussi des compléments à nos 20 premières mises au point sur les Aphyllophorales non porées de la Réunion. D'autre part plusieurs de nos récentes publications ont traité certains genres à l'échelle du globe et signalé des récoltes ou même des espèces nouvelles de la Réunion que nous rappellerons, le plus souvent en présentant des clés des espèces réunionnaises de ces genres. Ces articles sont : Boidin Lanquetin & Gilles (1991) sur les *Peniophoraceae*, (1997) sur les *Asterostroma* et (1997) sur les *Gloeocystidiellaceae* sensu lato ; Boidin & Gilles (1994) sur les espèces à basides urniformes, (1998) sur les genres *Dendrocorticium*, *Dendrodontia* et *Dentocorticium*, (1999) sur le genre *Vararia*, et (sous presse)sur le genre *Epithele*, sur le genre *Kavinia* et sur le genre *Hypochnicium.* Ont été, en outre, signalés de la Réunion : *Candelabrochaete verruculosa* Hjortst. et *Cylindrobasidium torrendii* (Bres.) Hjortst. (Boidin & Gilles 1990) et, dans un article sur l'Ethiopie, *l'Amylocorticium africanum* (Boidin 1995).

Lieux de récoltes : Afin de préciser de manière concise les lieux de récoltes, nous avions choisi des dénominations présentées dans trois notes : Boidin & Gilles 1986, 1988 et 1991, suite à nos séjours en. commun du 12 avril au 11 mai 1985, du 12 mars au 16 avril 1987 et du 10 mars au 18 avril 1990. Depuis lors, cinq autres séjours ont été effectués : par J. Boidin du 8 au 28 mars 1995, puis par G. Gilles du 18 novembre au 9 décembre 1996, du 22 avril au 18 mai 1997, du 20 mars au 30 avril 1998 et du 20 mars à fin avril 1999. Lorsque les lieux visités avaient été signalés dans les trois notes rappelées ci-dessus, nous utiliserons leurs dénominations suivies de l'année abrégée : par exemple Bébour II-96. Mais d'autres lieux ont été prospectés notamment en 1995, 1998 et 1999, dont voici les désignations : En 1995, les lieux nouveaux se situent près de la côte Est de l'île ; citons du Nord au Sud : St. André, au dessus des Deux-Rives ; Bassin de la Paix, à l'Ouest de Bras Panon ; Bethléem, Piton Papangue, en montant vers Takamaka ; Palmistes VII, chemin menant au Grand Etang, et, plus au Sud : Bois Blanc, au Nord de ce village sur la D 57, et le Tremblet, en bord de mer. En 1998, il faut ajouter : Salazie I, entrée du cirque vers 450 m. d'altitude ; Salazie II, près .Mare à Poule d'eau, altitude 550 m. ; Salazie III, Hellbourg et environs, altitude 1.000 m. ; Salazie IV, Ilet à Vidot, altitude 950 m., ainsi que Ravine Ango, à l'Est de St.Philippe, à l'angle S-E de l'île, près - e la côte, altitude 50 m.. En 1999, il faut signaler : N.D. de la Paix IV, en descendant vers le Tampon, altitude 1.400 m. ; Basse Vallée, à l'Ouest du Baril, altitude 100-150 m., et Pont Babet, ravin au Nord de Langevin, altitude 150 m.

Les notations des couleurs des basidiomes proviennent du Munsell Soil Color Chart ; y sont parfois ajoutées des dénominations en anglais puisées dans Ridgway.

Les abréviations suivantes seront utilisées : AC : assez commun ; C : commun ; Am.N. : Amérique du Nord ; SA + et SA- pour sulfoanisique positif ou négatif ; s.d. pour sans description ; cf. confert, lorsqu'une récolte se rapproche sans pouvoir être identifiée sans réserves avec le nom d'espèce retenu. Les données sur les caractères culturaux sont résumées selon le code de Nobles complété (voir Nakasone 1990)

Un nom de genre placé entre "guillemets" est considéré comme non satisfaisant, mais utilisé faute de mieux. La numérotation prend la suite des 127 espèces signalées dans les notes I à XX consacrées à la flore réunionnaise.

Le jour de la récolte, les champignons sont mis à sporuler, si nécessaire après réhumidification, au-dessus de lames plastiques stérilisées. Ceci permet de connaître, de mesurer avec précision et de conserver des spores projetées mûres, et, éventuellement d'obtenir des cultures. Les mesures de spores sont toujours effectuées par prélèvement d'un fragment de lame plastique monté entre lame et lamelle dans KOH/phloxine. Lorsque la spore est amyloïde, les mesures peuvent être faites dans le Melzer, ce qui est alors indiqué.

A- BEENAKIACEAE Jülich 1981-

Un représentant du genre *Kavinia* Pilat 1938 a été décrit de la Réunion :

128- *Kavinia salmonea* Boid. & Gilles au basidiome rose saumoné en herbier, fait de petits aiguillons portés par un subiculum stérile avec marge fibrilleuse blanche parfois rhizomorphique. Les spores largement ellipsoïdes, à paroi jaune ornée de verrues obtuses , mesurent 4,2-5,2x2,8-3,5-(4) µm donc nettement plus petites que celle du *Kavinia alboviridis* (Morgan) Gilberts. & Bud.. Nous renvoyons à sa description récente (Boidin & Gilles, Cryptogamie-Mycologie, sous presse).

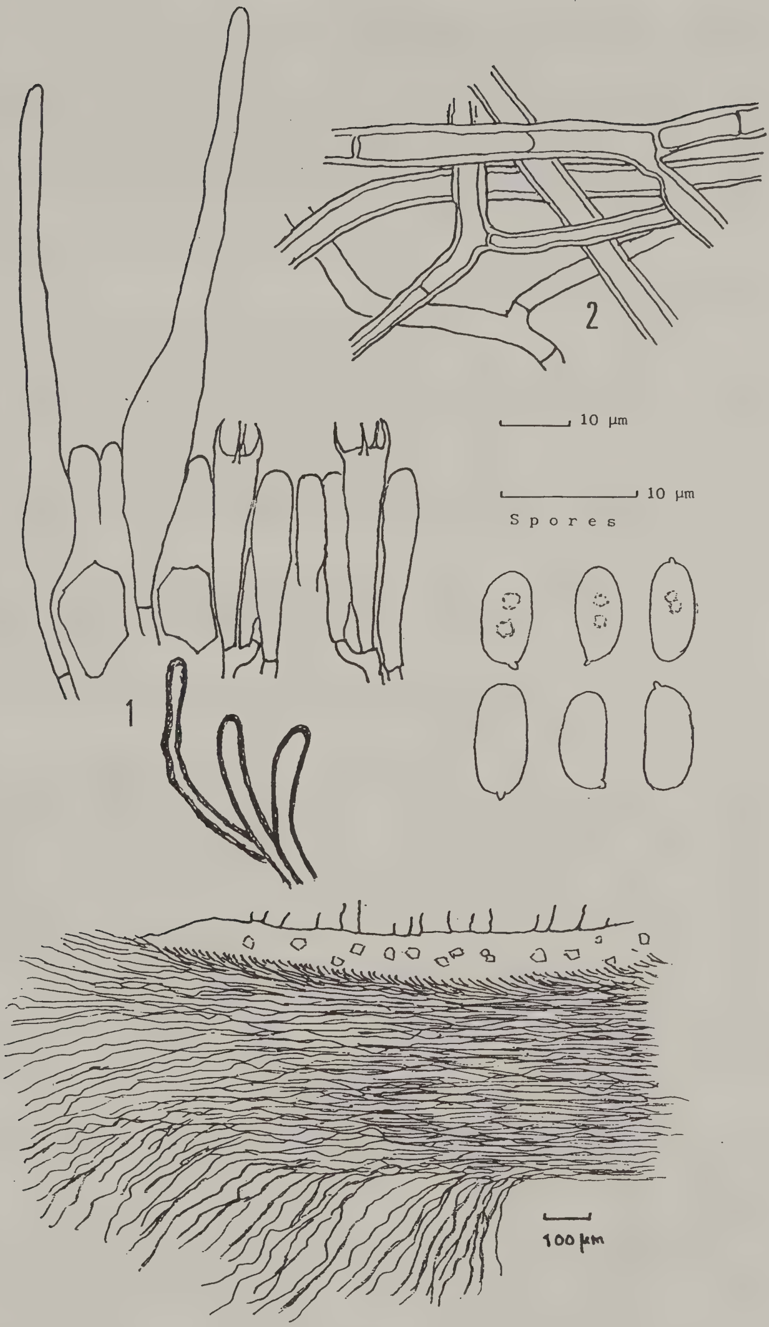
2
10 µm
10 µm
Spores
1
100 µm

Planche I: *Boreostereum borbonicum* nov.sp.: LY 17.364, holotype, sauf spores de LY 17694.

B- BOREOSTEREACEAE Jülich 1981

Le genre *Boreostereum* Parm. 1968 a été créé pour le *Stereum radiatum* Peck décrit de la république tchèque mais signalé en Amérique du Nord et en Asie. Un autre espèce y a été transférée, le *Stereum vibrans* Berk.& Curt.1868 par Davydkina & Bondarceva (in Bondarceva & Davydkina 1976) connue en Amérique et au Japon. Ce genre se distingue du genre *Stereum* par ses spores non amyloïdes et ses hyphes en majorité ramifiées à paroi épaisse et brunie.

129- *Boreostereum borbonicum* sp. nov. Pl. 1

Effusum. Hymenio laevi subfusco usque ad obscure violaceum dummodo imbuto, margine pallidiore saepe soluta et flexibili ; sterili facie velutina fusca. Fusco contexto constanti ex jacentibus hyphis crasse tunicatis efibulatisque, ramosis quae emergent et ad fusca, x 3-3,5µm, semper inclusa pseudo cystidia transeunt. Hymenio spisso 50-80 µm ; ex claviformibus, 24-30 x 6 µm, efibulatis basidiis et tenuiter tunicatis, SA-, saepe emergentibus leptocystidiis constanti. Sporae subcylindratae haud depressae, 5,5-8 (9) x 3-4,2 µm, laeves, haud amyloideae, binucleatae. Holotypus LY 17364. Réunion.

Etalé, à hyménium lisse, mastic à l'extrême marge (5 YR 7/2), puis brun (5/2, benzo brown Ridgway) à violet sombre (10 YR 5/1, quaker drab) au centre quand il est très humide. La marge est légèrement décollée, mais peut devenir largement libre, molle et souple sur les petites branchettes. La face stérile est brune (5 YR 5/3 à 2,5 YR 3/2, bone brown), un peu hirsute. En herbier, l'hyménium est beige rosé (7,5 YR 7/2 à 8/2), la face stérile est brun de suie (7,5 YR 4/2 à 4/4), veloutée.

Coupes hautes de 300 à 700 µm, dont 50 à 80 µm d'hyménium hyalin riche en cristaux ; le contexte horizontal est brun et fait d'hyphes en majorité à paroi ferme à épaisse, brune, à cloisons simples, x 2,5-7 µm, souvent ramifiées, et de quelques rares hyphes génératrices à paroi plus mince et plus pâle, sans boucles. Les hyphes brunes se redressent au bas de l'hyménium passant à des pseudocystides brunes n'atteignant pas la surface ; elles sont nues, obtuses, et ont 3-3,5 µm de largeur. Pas de cortex. Des leptocystides hyméniales fusiformes, obtuses, à paroi mince et contenu peu remarquable, 10-100 x 5-9 µm ; elles peuvent émerger de 30-50 µm et ne réagissent pas au SA. Basides clavées, 24-30 x 6 µm à 4 stérigmates ; leur paroi est un peu ferme à la base qui est sans boucle. Spores subcylindriques, non déprimées pour les plus grandes, subellipsoïdes pour les plus courtes, 5,5-8-(9) x 3-4,2 µm, à paroi lisse, non amyloïde ; elles sont binucléées ; $\bar{x}$ = 6,72±0,69 x 3,40 ± 0,24 pour LY 17.694.

Récoltes : LY 16153, Puits Arabe-95 ; 16.221, Piton Papangue-95 ; 16.232, sur *Rubus alcaefolius*, Bethléem-95 ; 17.364, holotype, Puits Arabe-98 ; 17.694, Puits Arabe-99.

La culture polysperme de 17.694 devient vite brun foncé et ne montre que des hyphes sans boucles.

Les hyphes brunes du contexte étant cloisonnées et souvent ramifiées ne peuvent être appelées hyphes squelettiques. Nous plaçons cependant cette espèce auprès du *Boreostereum radiatum* car Parmasto (1968) comme Chamuris (1988, p.46 et fig.13) parlent de squelettiques ramifiées ou branchues. Notre espèce diffère du type par son hyménium lisse, l'absence de cortex, des leptocystides différentes et non piquetées de petits cristaux, des hyphes plus larges, des spores plus courtes mais binucléées comme chez *B. radiatum* ; en outre *B. borbonicum* ne teint pas la potasse en vert.

C- CERATOBASIDIACEAE Martin 1948.

Se placent ici les genres à basides non cloisonnées, mais dont les spores germent par répétition. Aux espèces de cette famille citées dans les notes V et X, il faut en ajouter deux : un *Ceratobasidium* et un *Hydrabasidium*.

130- *Ceratobasidium* cf. *globisporum* Warcup & Talbot, New Phytol. 86 : 267, fig.1, 1980.

Étalé, hypochnoïde, cacao clair (7,5 YR 6,5/4) ; en herbier, argillacé (10 YR 7/4). Hyphes inférieures larges de 13-14 µm avec paroi de 1 µm environ, sans boucles. Basides subcylindriques, 19-26 x 10,5-12,5 µm à 2, 3 ou 4 stérigmates longs de 12-18-(24) µm. Spores sphériques lisses, 8,8-13 µm ou 9-13 x 8,5-12 µm, non amyloïdes, germant par répétition ($\bar{x}$= 10,72 ± 0,96). Dans le Melzer on voit des massses brunes dans de nombreuses cellules (Pl.2, fig.A).

Récolte : LY 14.170, sur bois très dégradé, Textor-90.

Cette unique récolte, aux spores sphériques semblables à celles du *C.globisporum*, diffère cependant par des basides plus cylindriques, parce que nées sur des hyphes sous-basidiales plus larges et qui ne portent parfois que 2 ou 3 stérigmates, par des hyphes basales plus larges ; elles ne mesurent que 7-9 µm sur le matériel d'Australie. Le *C. sphaerosporum* Warcup & Talbot (1971) a des spores plus petites, 6,5-9 µm, et des hyphes beaucoup plus étroites.

131- *Hydrabasidium subviolaceum* (Peck) Erikss.& Ryv.,Cort.N.Europe 5 : 897, fig. 451-452, 1978.

Hypochnus subviolaceus Peck, N.Y.St.Mus.Rept. 47 : 151, 1894 ; Saccardo, Syll.Fung. 11 : 130, 1895 ; Burt, Ann.Miss.Bot.Gard. 13 : 323, 1926 ; Larsen, Mycologia 58 : 601, 1966.

Oliveonia subviolacea (Peck) Larsen, Mycol.Mem. 4 : 128, 1974, s.d.

Scotomyces subviolaceus (Peck) Jülich, Persoonia 10 : 334, 1978, s.d.

= *Corticium atratum* Bres. Hedwigia 35 : 290, 1896 ; Rick, Broteria 3 : 154, 1934.

Ceratobasidium atratum (Bres.) Rog. & Martin, Lloydia 4 : 262, 1941 ; Rogers & Jackson, Farlowia 1 : 272, 1943 ; Wakefield, Tr.Brit.Mycol.Soc. 35 : 64, fig.360 b, 1952 ; Martin, Iowa St.Nat.Hist. 19 : 12, 1952 ; Rick, Iheringia 4 : 99, 1959 ; Lowy, Fl. neotr. 6 : 116, 1971.

Oliveonia atrata (Bres.) Talbot, Persoonia 3 : 381, 1965 ; Wells, Mycologia 86, 20, fig.13-14, 1994.

= *Corticium fallax* G.H.Cunn. Trans.Roy.Soc.New Zeal. 82 : 309, fig.25, 1954 ; G.H. Cunningham, New Zeal. Dept. Sci. Ind. Res. Bull. 145 : 77, fig.34, 1963.

Scotomyces fallax (G.H.Cunn.) Jülich, Persoonia 10 : 139, 1978.

= *Tulasnella metallica* Rick, Broteria 3 : 169, 1934.

= *Ceratobasidium plumbeum* Martin, Mycologia 31 : 513, fig.21-27, 1939.

= *Ceratobasidium subatratum* Rattan, Bibl. Mycol. 60 : 203, fig.A-B p.195, 1977 (selon Roberts & Spooner, Kew Bull.53 : 634, 1998).

Hypochnoïde puis membranuleux, séparable, gris violacé (5 YR 6/1 à 5,5/1). En herbier, gris bleuté (vers Neutral 5 à 5,5). Coupe haute de 100-200 µm avec quelques hyphes basales horizontales, x 2,5-5 µm, bouclées, à paroi mince, puis tout vertical. Les boucles sont constantes et germent très souvent en rameaux ; les hyphes ne sont pas cyanophiles, mais elles sont localement brunies ou noirâtres. Basides s'élargissant vite de bas en haut, 15-25 x 7,5-12 µm au sommet, à 4 stérigmates, d'abord en doigt de gant, puis effilés, longs de 8-12-(19) µm ; elles sont bouclées et leur contenu peut devenir brun foncé. Spores subglobuleuses, 6-9 x 5,3-7,5 µm, à paroi un peu ferme, lisses, uninucléées, non amyloïdes ; elles germent par répétition. ($\bar{x}$ = 6,61±0,36 x 5,90±0,35 pour LY 14.461 ; 7,80±0,62 x 6.60±0,49 pour LY 14153). (Pl.2, fig. B).

Récoltes : LY 14153, sur vieux bois au sol, Bébour VII-90 ; 14.371, Baril III-90 ; 14.461, id. ; 16.167, Le Tremblet-95 ; 17.374, Baril II-98 ; 17.713, Baril II-99.

Selon Wakefield (1952) ou Eriksson & al. (1978), les spores mesurent, en Europe du Nord, 7-9 x 4-5,5 µm ; elles sont donc plus étroites que sur nos récoltes réunionnaises. Pour Cunningham (1954, 1963), *Corticium fallax* a des spores 6,5-9 x 6,5-7 µm, donc plus épaisses, plus subglobuleuses ; pour Martin (1952), *Ceratobasidium atratum* a des spores 6-9 x6-8 µm donc bien subglobuleuses comme à la Réunion. Par contre, pour *Oliveonia atrata*, Talbot (1965) donne 7,5-10 x 5,5-6 µm !
S'il n'existe, réellement, qu'une seule espèce d'*Hydrabasidium*, cette espèce aurait une étonnante dispersion : Amérique du Nord (Canada pays du type, U.S.A), Amérique centrale (Panama, Iles Caraïbes), Amérique du Sud (Brésil, Guyane britannique), Europe (Norvège, Suède, Angleterre et France, selon Eriksson & Ryvarden), Océanie (Nouvelle Zélande, Nouvelle Calédonie), et nous ajoutons Afrique (Ile de la Réunion).

D- CYSTOSTEREACEAE Jülich 1981 :

Nous plaçons dans cette famille le genre *Cystidiodontia* proche du genre *Cystostereum* Pouzar.

Genre ***CYSTIDIODONTIA*** Hjortstam, Mycotaxon 17 : 571, 1983.

132- *Cystidiodontia isabellina* (Berk. & Br.) Hjortst. & Ryv., Mycotaxon 25 : 549, 1986, s.d.; Niemelä, Renvall & Hjortstam, Edinb. J. Bot. 55: 479, 1998.

Kneiffia isabellina Berk. & Br., J. Linn. Soc. Bot. London 14 : 62, 1875 ; Petch, Ann. Roy. Bot. Gard. Peraden. 9 : 140, 1924.

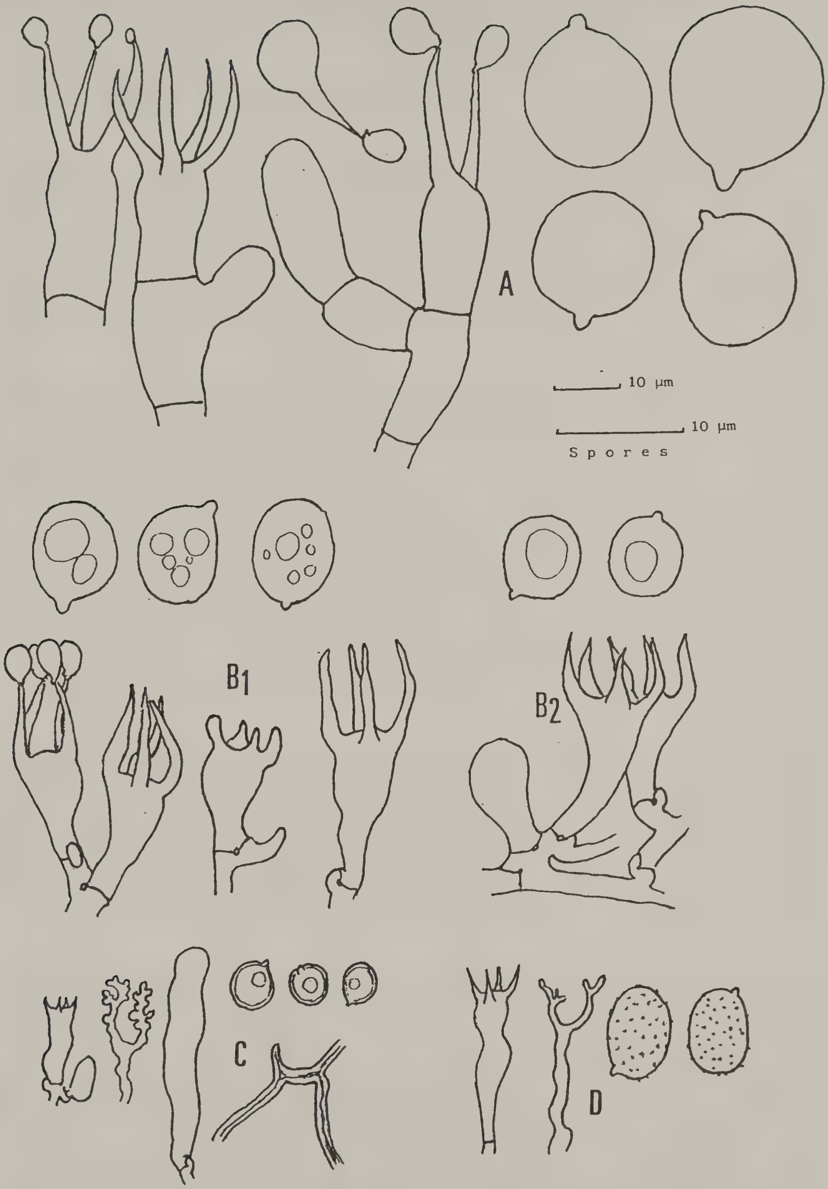
A
10 µm
10 µm
Spores
B1
B2
C
D

Planche 2: A- *Ceratobasidium* cf. *globisporum* LY 14.170; B- *Hydrabasidium subviolaceum*: 1) LY 14.153; 2) LY 17.374; C- *Cystidiodontia isabellina* LY 14.470 et spores de LY 12.564; *Boidinia dendrophysata* nov.sp.: LY 17.609, holotype.

= *Hypochnicium grandinioides* Ryv., Bull. Jard. Bot. Nat. Belg. 48 : 91, fig.7, 1978 (selon Hjortstam (1983), bien que Ryvarden le dise sans cystides).

= *Cystostereum artocreas* (Berk. & Curt. ex Cooke) Hallenb. & Ryv., Mycotaxon 2 : 135, 1975, sensu Hallenb. & Ryv.

= *Cystidiodontia artocreas* (Berk. & Curt. ex Cooke) Hjortst., Mycotaxon 17 : 571, 1983, sensu Hjortstam.

Etalé, adhérent, grandinioïde à finement odontioïde car aiguillons irréguliers, serrés, visibles seulement sous la loupe, écru (10 YR 7,8/3), alutacé pâle (2,5 Y 8/4 à 7,5/4) ou même ocre (10 YR 7/4), crustacé, pouvant sur des troncs morts couvrir de grandes surfaces ; sa marge est nettement limitée, brusque, adhérente. En herbier, il apparaît uniformément crème (2,5 Y 8,2/4) ou crème saumoné pâle (7,5 YR 7,8/4), beige écru (10 YR 7,5/3) parfois plus foncé, ocre (10 YR 7/3,5), sublisse à l'œil nu, mais densément couvert de petits aiguillons serrés parfois fourchus sous la loupe.

Coupes hautes de 300-700 x 80 µm. Texture très dense, très peu lisible, nettement dextrinoïde et cyanophile notamment coté surface, avec gros amas de cristaux formant, notamment, le sommet des émergences. Hyphes très peu distinctes, densément emmêlées, étroites, x 1-2 µm, certaines à paroi épaisse et alors souvent ramifiées, d'autres à paroi mince peuvent montrer des boucles. Gloéocystides nombreuses, 20-50 x 4-8 µm, souvent obtuses, parfois un peu émergentes, au contenu gras, réfringent, un peu jaune, SA-, à paroi mince ou peu épaisse. Petites basides, 10-14-17 x 3,5-4 µm à 4 stérigmates, faiblement clavées, parfois étranglées à mi-hauteur, bouclées. Dendrophyses grêles, plus abondantes au sommet des aiguillons. Spores subsphériques, 3-3,5 µm ou à face adaxiale faiblement aplanie, 3-4 x 2,5-3 µm, à paroi un peu épaisse, 0,2 µm environ et un peu cyanophile ; elles sont uninucléées. (Pl.2, fig.C)
Caractères culturaux de LY 14.145 : 2a(b)-3-15b-21-32-36-38-44-48-53-54-60-61.

Récoltes : République Centrafricaine : LY 5882, sur *Celtis milbraedii*, La Maboké, 11-9-1967 ; 6120, près Lolomo, 10-10-1967 ; REUNION : 11.501, Bébour II-85 ; 12.564 et 12.590, Bébour II-87 ; 12.820, Baril II-87 ; 12.873, Baril III-87 ; 12.875, 12.880, 12.883, Tévelave-87 ;14.139, Palmistes IV-90 ; 14.145 et 14.211, Baril I-90 ; 14372 et 14.470, Baril III-90 ; 14.432 et 14.433, Baril II-90 ; 16.846, Palmistes V-97 ; 17.263 et 17.413, Salazie IV-98 ; 17.376, Baril III-98 ; 17.624, Salazie IV-90, tous sur troncs ou grosses branches tombés au bois très dur.

Cette espèce, décrite de Sri-Lanka et largement répandue en Afrique tropicale a été confondue avec le *Michenera artocreas* Berk. & Curt. 1868 d'Amérique, transféré dans les genres *Hydnum* (Cooke 1891),*Cystostereum* (Hallenberg & Ryvarden 1975), puis *Cystidiodontia* (Hjortstam 1983) ; mais ce dernier auteur l'appelle en 1990 *Cystidiodontia laminifera* (Berk. & Curt.1868) Hjortst. et le dit seulement connu d'Amérique centrale et du sud. Cette espèce se différencierait du *C. isabellina* par l'absence de dextrinoïdie et de cyanophilie des hyphes.

Si la description macroscopique de l'*Hypochnicium grandinioides* du Rwanda évoque bien cette espèce, notamment : "crowded grandinioid hymenium, looking almost smooth to the naked eye" ainsi que la description des spores, des agglomérats de cristaux des aiguillons..., il est curieux que son auteur le dise sans cystides ; il le dit aussi monomitique. Certes le mitisme est ici très discutable ; les éléments grêles très ramifiés peuvent-ils être appelés "fibres" ? Hallenberg et Ryvarden, sous le nom de *C. artocreas*, le disent dimitique.

E- DACRYOBOLACEAE Jülich 1981 :

Genre ***DACRYOBOLUS*** Fr., Sum. Veg. Scand. 2 : 404, 1849 ; Eriksson, Symb. Bot. Upsal. 16 : 115, 1965 ; Oberwinkler, Zeitschr. f. Pilzk. 31 : 40-44, 1965 ; Eriksson & Ryvarden, Cort. N. Europe 3 : 340-349, 1975.

Basidiome lisse ou odontioïde ; longues basides étroites ; spores cylindriques incurvées très étroites, non amyloïdes ; sans cystides ou, plus souvent, avec cystides cylindriques nues ou avec dépôts cristallins ; contexte monomitique ou subdimitique, bouclé.

Sur les 4 espèces actuellement connues, deux espèces courantes en Europe, mais aussi en Asie et en Amérique, ont été retrouvées à la Réunion.

Clé des *Dacryobolus* de la Réunion :

- Hyménium lisse, fendillé sec et à marge soulevée ; riche en hyphes à paroi épaisse soluble dans les bases, et longues cystides cylindriques à paroi épaisse sauf près du sommet, nues ou porteuses de dépôts cristallins parfois étagés ; spores 4,7-5,5 x 1-1,3 µm. 133- *Dacryobolus karstenii* (Bres.1897, Stereum) Oberw. ex Parm. 1968.

- Hyménium odontioïde aux hyphes axiales très longues, x 5-8 µm, pouvant secréter sur le frais des gouttes visqueuses ; spores 4,8-5,8 x 0,7-1 µm. 134-*Dacryobolus sudans* (Fr. 1821, *Hydnum*) Fr. 1849.

133- *Dacryobolus karstenii* (Bres.) Oberw. ex Parm. Consp. Syst. Cort. 98, 1968.

Stereum karstenii Bres. Att. I. R. Accad. Agiati III 109, 1897 ; Bourdot & Galzin, Hymen. France 385, 1928.
Tubulicrinis karstenii (Bres.) Donk, Fungus 26 : 14, 1956, s.d. ; Thind & Rattan, Proc. Ind. Ac. Sc. 71 : 119, fig.1, 1970
Peniophora crassa Burt ap. Peck, N. Y. St. Mus. Rept. 54 : 155, 1901

En herbier il est étalé, orbiculaire, à marge brusque souvent légèrement soulevée, assez épais, 500-700 µm, mais tendre à la coupe, profondément fendillé, alutacé pâle (10 YR 8,5/4 à 3), isabelle (7,5 YR 7/4).

Contexte hyalin ; observé dans l'eau ou dans le Melzer, il se montre riche en hyphes emmêlées, la plupart à aspect de fibres, x 2,5-4,5 µm à paroi 1-1,5 µm, et d'autres, x 3-4 µm, régulières, à paroi mince et bouclées ; observées dans le Congo ammoniacal, les hyphes fibroïdes perdent leur paroi épaisse et l'on ne voit plus que des hyphes à paroi mince, ramifiées, bouclées, associées à des hyphes peu remarquables car à paroi très mince (ex-fibroïdes). Hyménium épais de 60-80 µm fait d'hyphes étroites, x 1,5 µm environ, serrées, souvent sinueuses, et de basides larges de 4,5 µm au sommet qui porte 4 stérigmates ; leur long stipe grêle difficile à suivre jusqu'à la boucle basale

dépasse 30 µm de longueur. Cystides 150-250 x 4-6,5 µm pouvant émerger de 40-60 µm, cylindriques, obtuses, à paroi épaisse de 2-2,5 µm sauf vers le sommet ; elles peuvent porter quelques cristaux parfois groupés en anneaux superposés ; de nombreuses cystides sont moins différenciées et plus grêles, hyphiformes et nues. Spores cylindriques étroites faiblement incurvées, 4,7-5,5 x 1-1,3 µm, non amyloïdes.
Récoltes : LY 12.718, sur *Cryptomeria japonica*, Cilaos V-87 ; 12.858, Baril III-87.

Comme cela arrive souvent en régions tropicales, les spores sont un peu plus petites. Par exemple, sur une récolte de France LY 15.514, la sporée montre des spores (5)-6-7 x 1,2-1,5 µm, plus incurvées.

134- *Dacryobolus sudans* (Fr.) Fr. Summ. Veg. Scand. 404, 1849 ;

Eriksson, Symb. Bot. Upsal. 16 : 115, 1958 ; Oberwinkler, Z. f. Pilzk. 31 : 42, t.6 fig.25, 1965 ; Eriksson & Ryvarden, Cort. N. Europe 3 : 347, fig. 140-141, 1975 ; Gilbertson & Lindsey, Gr. Bas. Natur. 35 : 293, fig.7, 1975 ; Gilbertson & Blackwell, Mycotaxon 28, 378, fig.3, 1987 ; Wu, Act. Bot. Fenn. 142 : 21, fig.11, 1990 ; Maekawa, Rep. Tottori Myc. Inst. 31 : 75, fig.50, 1993.

Nous ne redécrirons pas cette espèce bien connue en de nombreux pays. Notons cependant que ses aiguillons peuvent être plus ou moins nombreux, et parfois très longs, 5 ou même 6 mm. Nos spores sont, ici encore, un peu plus petites et plus étroites que dans la littérature : 4,8-5,8 x 0,7-1 µm. A l'exception de Gilbertson & Blackwell qui indiquent : 5-7 x 0,75-1 µm, tous les auteurs, européens ou asiatiques, les disent épaisses de 1-1,5 µm, ce que nous constatons en France. Par exemple, une récolte des Hautes-Alpes sur *Pinus sylvestris* a, sur sporée montée dans KOH/Phloxine, des spores 5,8-7,2 x 1,3-1,5 µm.
Récoltes : LY 11.458, sur *Anthirea verticillata*, Bébour III-85 ; 11.667, Palmistes I-85 ; 12.848 et 12.854, Baril III-87 ; 12.721 et 12.727, Cilaos V-87 ; 12.741, Cilaos XII-87 ; 17.741, Cilaos IX-99.

F- GLOEOCYSTIDIELLACEAE (Parm.) Jülich emend. Boidin, Mugnier & Canalès 1998

Suite à une étude comparative de fragments d'acides nucléiques, nous avons (Boidin & al.1998) proposé la répartition des *Gloeocystidiellum* sensu lato en deux familles, celle des *Gloeocystidiellaceae* sensu stricto essentiellement pour les espèces à spores ornées, plaçant dans les *Gloiotheleaceae* les espèces à spores lisses. Nous allons traiter successivement ces deux familles.

Clé des *Gloeocystidiellaceae* de la Réunion :

1- Basides répétitives à paroi congophile et dextrinoïde; texture dense; spores oblongues à subovoïdes, 4-7,2 x 3,2-4,5 µm; gloéocystides SA+ faible ou SA-, à paroi épaissie à la base. C à moyenne altitude 139- *Conferticium heimii* (Boid.1966) Wu 1996
1- Basides non répétitives 2

2- Sans boucles. 3
2- Boucles constantes. 6
3- Basidiome céracé tendre, jaune orangé à orange vif; basides étroitement clavées; gloéocystides 100-400 x 10-24 µm au contenu jaune doré, SA faible mais verdissant dans le Melzer; spores oblongues, 4-6 x 3-4 µm, binucléées. C à basse et moyenne altitude. 142- *Gloeocystidiopsis flammea* (Boid.1966) Jülich 1982
3- Basidiome blanc, crème ou jaunâtre; basides utriformes; spores uninucléées. 4
4- Spores sphériques, 3,6-5 x 3,2-4 µm; hyphes plus ou moins soudées et gélifiées; AC en moyenne altitude 136- *Boidinia cana* Wu 1996
4- Spores plus grandes. 5
5- Spores subglobuleuses fortement verruqueuses, 6,2-7,5 x 5,2-6,5 µm; gloéocystides 45-130 x 6-13-(18) µm, SA faible; à basse et moyenne altitude.
135- *Boidinia borbonica* Boid., Lanq. & Gilles 1997
5- Spores oblongues aux ornements très fins, 6-7,5-(8) x 4,2-5,5 µm; gloéocystides SA-; petites dendrophyses. Maïdo II. 137- *Boidinia dendrophysata* nov.sp.
6- Basidiome grandinioïde; spores ellipsoïdes, 4-5 x 3-3,5µm; basides utriformes; à basse altitude. 138- *Boidinia granulata* Wu 1996
6- Basidome lisse; spores aux ornements peu marqués; basides clavées 7
7- Sulfocystides moniliformes, 35-150 x 6-14 µm à paroi mince; spores ellipsoïdes courtes, 4,2-5 x 3,3-4 µm. Plaine des Palmistes et Bébour.
141- *Gloeocystidiellum moniliforme* Wu 1996
7- Sulfocystides non moniliformes, les profondes à paroi épaissie dans leur moitié inférieure, 20-140 x 8-18 µm; spores ellipsoïdes (3,7)-4-5 x 3-3,6 µm; C à moyenne altitude. 140- *Gloeocystidiellum kenyense* Hjortst.1987

A l'exception du *Boidinia dendrophysata* décrit ci-après, les autres espèces ont été décrites récemment (Boidin, Lanquetin & Gilles 1997) et nous renvoyons le lecteur à cette publication..

137- *Boidinia dendrophysata* nov.sp. Pl. 2, fig. D.

Effusa, laevis, subflava, adhaerens et, ubi sicca, coriacea; spissa usque ad 500 µm; constans ex hyphis parum separatis, efibulatis. Basidiis utriformibus, 17-26 x 5,5-6,5 µm et parvis dendrophysis parum ramosis. Sporae oblongae, 6-8 x 4,2-5,5 µm, amyloideae, subtiliter ornatae, binucleatae. Holotypus 17.609. Réunion.

Etalé, lisse, jaunâtre (10 YR 8/2 à 7,8/2), très adhérent, à marge nette. Basidiome très coriace sec.

La coupe atteint 500 µm; elle est riche en oxalate, très dense, aux éléments très peu distincts. Hyphes sans boucles. Gloéocystides peu remarquables, SA-, les unes subcylindriques parfois avec une schizopapille au sommet, d'autres, incluses, plus élancées, ovoïdes, x 8-9 µm. Basides utriformes, 17-26 x 5,5-6,5 µm à 4 stérigmates longs de 5 à 6 µm. Entr'elles, quelques petites dendrophyses peu divisées. Spores oblongues, 6-7,5-(8) x 4,2-5,5 µm, amyloïdes, très finement ornées, binucléées ($\overline{x}$ = 6,71±0.47 x 4,83±0,30 pour le type).

Récolte: LY 17.609, sur *Solanum auriculatum*, Maïdo II-99, holotype.

Le genre *Dendrophysellum* Parm.1968 (p.146) ne convient pas car ses spores sont lisses, ses dendrophyses portent des dépôts résinoïdes jaunâtres et, surtout, il est dépourvu de gloéocystides.

G- GLOIOTHELEACEAE Boid., Mugnier & Canalès 1998.

Cette famille regroupe, pour l'essentiel, les ex-*Gloeocystidiellum* sensu lato à spores lisses, c.-à-d. le genre *Gloiothele* sans boucles et le genre *Megalocystidium* bouclé, aux spores cylindriques. Rappelons toutefois que 3 espèces de ce dernier genre, inconnues à la Réunion, ont des spores cylindriques très légèrement ornées , ce qui pose problème.

Le *Gloiothele globosa* Wu a été signalé et décrit de la Réunion (Boidin, Lanquetin & Gilles 1997, p.51); nous ne le redécrirons pas ici, mais signalerons deux autres espèces de ce genre, connues jusqu'ici en Afrique, et un nouveau *Megalocystidium*.

Clé des *Gloiotheleaceae* de la Réunion :

1- Hyphes bouclées; sulfocystides ovoïdes avec sphère au sommet; spores oblongues, 4,2-6 x 2,8-3,5 µm; sur *Aleurites mollucana* mort au sol; Puits Arabe.
146- *Megalocystidium gloeocapitulatum* nov.sp.
1- Hyphes sans boucles. 2
2- Des émergences stériles coniques, subcylindriques ou aplaties; basidiome ocre à isabelle; gloéocystides 25-180 x 5-20 µm faiblement SA+; spores subréniformes, 6-7,5 x 4,5-5,2 µm avec bavette. Cilaos. 145- *Gloiothele lamellosa* (P.Henn.1902)Bres.1920
2-Sans émergences stériles.
3- Spores sphériques, 5,5-6,8 x 5,2-6,5 µm; basidiome jaunâtre à marge fibrilleuse; sulfocystides 70-150 x 5-12 µm; à basse altitude, mais aussi à N.D.de la Paix.
143- *Gloiothele globosa* Wu 1996
3-Spores oblongues courtes, 5,2-6,5 x 4,2-5 µm; basidiome crème, rigescent; sulfocystides80-165 x 6-13 µm. Salazie, Ravine Ango.
144- *Gloiothele humilis* (Boid.1966) Boid. & al. 1997

144- *Gloiothele humilis* (Boid.) Boid., Lanq. & Gilles, Bull.Soc.Mycol. France 113: 52, pl.6 h, 1997.

Gloeocystidiellum humile Boidin, Cahier Maboké 4: 9, Pl.1 B, 1966.

Cette espèce décrite de Centrafrique et retrouvée au Gabon n'est pas rare à la Réunion.
Récoltes: LY 17.277, Salazie II-98;17.297, Salazie IV-98; 17.381, Ravine Ango-98; 17.690, Ravine Ango-99. Nous renvoyons à la description de 1997.

145- *Gloiothele lamellosa* (P.Henn.) Bres., Ann.Mycol. 18: 44, fig.3, 1920; Boidin, Lanquetin & Gilles, Bull.Soc.Mycol.France 113: 54, 1997.

Poria lamellosa P.Henn. Engl. Bot. Jahrb. 33: 35, 1902.

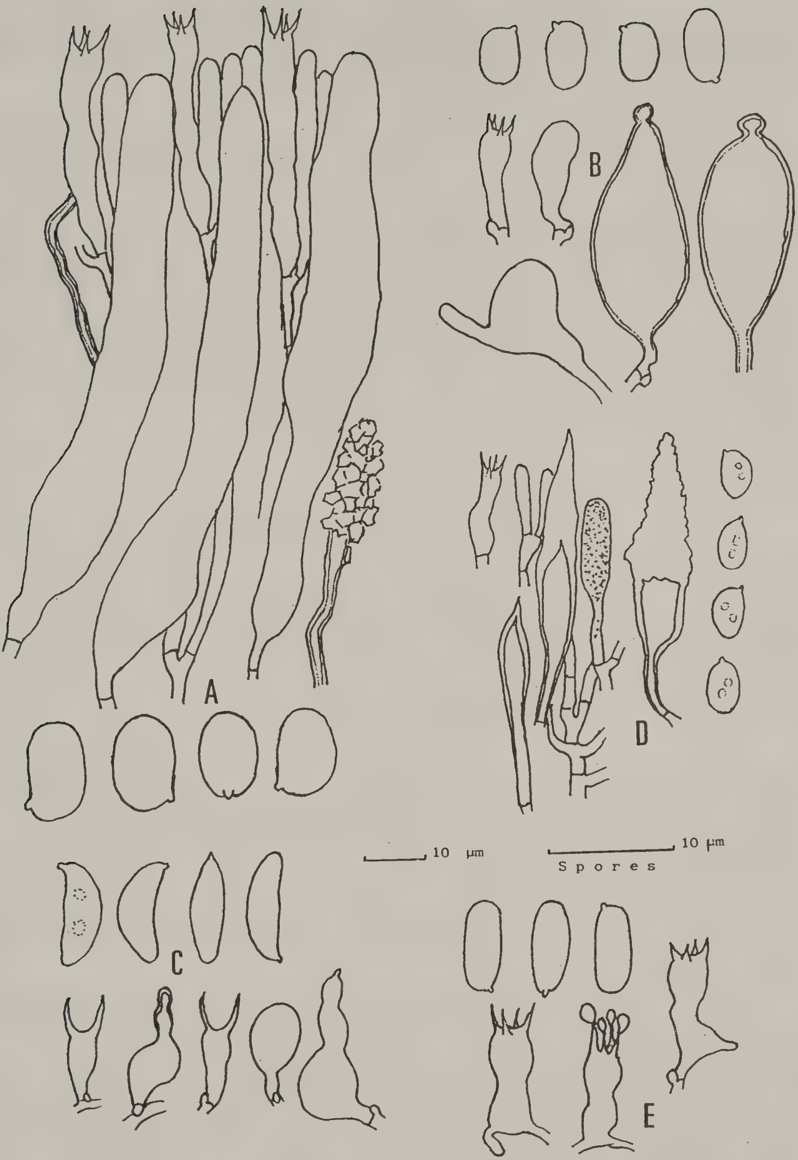

Planche 3: A- *Gloiothele lamellosa*, LY 17.733; B- *Megalocystidium gloeocapitulatum* nov.sp.: LY 17.697; C- *Sphaerobasidium gloeocystidiatum* nov.sp., LY 17.724, holotype; D- *Peniophora dipyrenosperma* nov.sp., LY 16.799: à gauche, hyménium après traitement alacalin à chaud (cystides sans leurs cristaux); E- *Aphanobasidium acanthophoenicis* nov.sp. LY 12.929, holotype.

Largement étalé, couvert de petits aiguillons irréguliers, parfois multifides, serrés, parfois regroupés en touffes ou en petites crêtes; marge atténuée, nette, couleur ocrée à isabelle (7,5 YR 7/6) sur le frais, un peu plus pâle sec (7,5/4).^^

Contexte épais de 200-400 µm entre les aiguillons qui émergent de 50-80 µm ou davantage; il est constitué d'hyphes étroites, x1,5-2 µm, quelques unes subhorizontales à la base, puis emmélées en tous sens, à cloisons simples, à paroi mince à sensiblement épaissie jusqu'à 1 µm, à aspect de fibres, x 2-3,5 µm. Sous-hyménium fait d'hyphes verticales, la plupart à paroi mince sauf à la base des aiguillons où elles sont plus larges, x 3-4 µm et passent à des sortes de petits métuloïdes, x 5-10 µm avec les cristaux, très nombreux au sommet des aiguillons. Nombreuses gloéocystides subcylindriques, parfois élargies près de leur base, 25-120-(180) x 5-17-(22) µm,à paroi mince ou un peu ferme à la base, au contenu très gras, faiblement SA+. Basides subcylindriques, 30-50 x 5-6 µm à 4 stérigmates. Spores oblongues courtes de face, non ou faiblement déprimées de profil, au contenu gras, à paroi lisse, amyloïde avec légère bavette, 6-7,5 x 4,5-5,2 µm ($\bar{x}$= 6,77 ±à,42 x 4,82±0,22). (Pl.3, fig. A).

Récolte: LY 17.733, Cilaos V-99.

Cette espèce se distingue des autres *Gloiothele* par sa tendance odontioïde et ses hyphes fibroïdes passant à de petits métuloïdes. Décrite de Tanzanie, elle a été récoltée en Centrafrique, en Malaisie, au Transval et à Madagascar; notre récolte réunionnaise ne montre pas une légère marge himantioïde signalée précédemment et possède davantage d'hyphes à paroi épaissie d'aspect fibroïde.

145- *Megalocystidium gloeocapitulatum* nov.sp. Pl.3, fig. B

Effusum, subceraceum, albidoflavidum dein flavum, subtiliter gibbosum. Contexto constanti ex jacentibus hyphis fibulatis, x 2-3,5 µm. Sulfocystidiis 10-80 x 6-20 µm saepe in summo sphaerulam gerentibus. Basidiis clavatis, 16-23 x 4,5-6 µm. Sporae oblongae, laeves, 4,2-6 x 2,8-3,5-(4) µm, amyloideae, binuclearae. Holotypus LY 17.697. Réunion.

Etalé, blanc jaunâtre à la marge, plus jaune au centre (10 YR 8/3), subcéracé avec bosses et tubercules épars. Marge pruineuse.

Coupe haute de 200-250 µm dont 80 µm d'hyménium; le contexte est horizontal et fait d'hyphes à paroi très mince, souvent peu régulières, bouclées, x 2-3,5 µm. Sulfocystides nombreuses à tous niveaux, au contenu riche; certaines sont des plagiogloéocystides; la plupart sont ovales avec une petite sphère au sommet; elles sont à paroi un peu épaissie et alors congophile, 10-55-80 x 6-18-(20)µm ; celles de l'hyménium sont souvent clavées, obtuses, environ 18 x 6-7 µm, à paroi mince. Basides clavées, 16-23 x 4,5-5 µm, bouclées, à 4 stérigmates. Spores oblongues, lisses, amyloïdes, 4,2-6 x 2,8-3,5-(4) µm, binucléées. ($\bar{x}$ = 4,95±0,42 x 3,22±0,26; R= 1,53).

Récoltes: LY 17.687, et 17.697,holotype, sur bois mort au sol d'*Aleurites mollucana* (Euphorbiacée), Puits-Arabe-99.

Espèce bien caractérisée par son contexte horizontal riche en sulfocystides dès la base, par ses sulfocystides avec sphère au sommet,- d'où le nom choisi : *capitulatus*, pourvu d'une petite tête. Il a les spores du *Gloeocystidiellum luridum* var. *microsporum* Chen & Lin (in Lin & Chen 1990), mais ce dernier a des gloéocystides cylindriques, 10-35 x 2,5-5 µm très différentes et les trois basides de leur figure 3 sont bisporiques.

H- LACHNOCLADIACEAE Reid, 1965

Ayant publié récemment des mises au point sur les genres *Asterostroma* (1997) et *Vararia* (1999), nous nous contenterons de résumer nos connaissances sur les genres résupinés de cette famille sous forme de clés de détermination des espèces de la Réunion.

Clé du genre *Asterostroma* Massee 1889 à la Réunion :

1- Spores subisodiamétriques, 5,5-7,5 x 5-7 µm à fortes épines atteignant 3 µm de hauteur (fig.1 D de 1997).
148- *Asterostroma spinososporum* Boid., Lanq. & Gilles 1997

1- Spores plus petites, 4,8-6 x 4-5,5 µm à tubercules arrondis ne dépassant pas 1 µm (fig.1 H de 1997). 147- *Asterostroma cervicolor* (Berk.& Curt.) Massee 1889

Ces deux espèces ont des spores amyloïdes, des cloisons sans boucles et possèdent des leptocystides SA- ou faiblement positives.

Clé des genres *Dichostereum* et *Vararia* à la Réunion :

1- Spores amyloïdes verruqueuses, subglobuleuses, 5-7 µm ; basidiome épais, beige à brun ; dichophyses coralloïdes, les inférieures brunies. En altitude : Maïdo, Nez de Bœuf, Bébour, Palmistes. 149- *Dichostereum orientale* Boid. & Lanq. 1980

1- Spores non amyloïdes ou avec seulement une bavette amyloïde ; 2

2- Hyphes sans boucles. 4

2- Hyphes bouclées. 3

3- Spores sphériques, 6,5-8,2 µm ; dichophyses géométriques au tronc à paroi épaisse ; des chlamydospores jaunes ; gloéocystides SA- ; basidiome chamois clair à jaune de Naples. Ravine de St.Gilles. 159- *Vararia sphaericospora* Gilberts.1965

3- Spores ovoïdes, 4-6-(7) x 3-4 µm ; dichophyses hyméniales flabellées capillaires au tronc à paroi épaisse ; sulfocystides ; basidiome cannelle à ocre orangé. Les Avirons, et sur *Syzygium cuminii* à Ravine-Ango.
151- *Vararia callichroa* Boid., Gilles & Lanq. 1988

4-Spores allongées, rapport longueur sur épaisseur supérieur à 2. 9

4- Spores courtes, rapport longueur sur épaisseur inférieur ou égal à 2 5

5- Dichophyses capillaires ; gloéocystides SA- ; spores binucléées 7

5- Dichophyses racémeuses ; sulfocystides. 6

6- Spores oblongues, 5-7 x 3,5-4 µm ; dichophyses au tronc à paroi épaisse. Sur *Psidium*, Palmistes. 160- *Vararia spissata* Boid .& Gilles 1999

6- Spores larmiformes, 13-16 x 8-9,5 µm ; dichophyses de faible envergure au stipe à paroi mince. Bébour, Palmistes. 154- *Vararia lacrimaspora* Boid. & Gilles 1999

7- Spores oblongues, 9-12 x 7-8 µm à paroi un peu ferme. Sur *Casuarina*, Puits Arabe.
162- *Vararia tropica* Welden 1965

7- Spores ovoïdes ou subamygdaliformes moins épaisses 8

8- Spores ovoïdes, 7,5-9 x 5-6 µm. Sur *Rubus*, Salazie II ; sur *Nastus*, Maïdo.

155- *Vararia minidichophysa* Boid. & Lanq.1975

8- Spores subamygdaliformes, 8-11 x 4,5-5,5-(6) µm. Palmistes et sur *Dendrocalamus* à Salazie IV.156- *Vararia minidichophysa* var. *amygdalispora* Boid., Gilles & Lanq.1987

9- Spores sans bavette amyloïde ; gloéocystides SA-. 10

9- Spores subaciculaires un peu courbées, 10-20-(23) x 2,7-3,5 µm avec bavette ; dichophyses capillaires. Les Avirons, le Baril.

152- *Vararia cremea* Boid., Lanq. & Gilles 1980

10- Spores incurvées en S, 13-22 x 2,5-3,5 µm ; dichophyses racémeuses au tronc dextrinoïde à paroi épaisse ; basidiome grisâtre à beigeâtre, mince, adhérent. AC en altitude. 158- *Vararia sigmatospora* Boid., Gilles & Lanq. 1987

10- Spores différentes. 11

11- Des bréviphyses, c.-à-d. de faible envergure car branches des premiers ordres très courtes. 12

11- Dichophyses à branches développées mais à rameaux ultimes courts, soit obtus (dichophyses racémeuses), soit pointus (dichophyses coralloïdes) 13

12- Spores en poire, 10-16,5 x 5-7 µm ; basidiome subcéracé, ocre alutacé à orange vif avec marge fibrilleuse pâle. AC en altitude.

157- *Vararia pirispora* Boid., Gilles & Lanq. 1987

12- Spores fusiformes, 15-21 x 4,3-6 µm. AC sur Casuarina cunninghamii, p.ex. à Salazie II. 150- *Vararia breviphysa* Boid. & Lanq. 1975

13- Spores étroites, un peu fusiformes, 13-17 x 2,5-3 µm ; dichophyses racémeuses. Cilaos. 161- *Vararia trinidadensis* Welden 1965

13- Spores ellipsoïdes à subamygdaliformes, 11-14-(16) x 4,5-6 µm à tendance biapiculée ; dichophyses superficielles coralloïdes. Sur *Philippia* et *Stoebe*, Palmistes.

153- *Vararia gomezii* Boid. & Lanq. 1975

Clé du genre *Scytinostroma* à la Réunion :

1- Spores amyloïdes. 2

1- Spores non amyloïdes. 4

2- Spores ovoïdes de face, déprimées de profil, 5,5-6,2 x 3-4 µm; fibres de surface à 2 longs bras sinueux. Cap Noir sur *Lantana camara* et sur bambous.

170- *Scytinostroma* cf. *renisporum* Boid., Lanq. & Gilles 1987

2- Spores subsphériques. 3

3- Spores 6,5-8,5 µm de diamètre avec fort apicule; dichophyses superficielles aux rameaux ultimes coniques. Bébour. 163- *Scytinostroma corneri* Boid. & Lanq. 1987

3- Spores plus petites, 4,5-6 µm; fibres peu ramifiées. A basse altitude: Baril, Ravine Ango, sur *Acanthophoenix*. 166- *Scytinostroma duriusculum* (Berk. & Br.) Donk 1956

4- Spores cylindriques déprimées, 8,5-12 x 4,5-5,5 µm, très grasses ; grandes sulfocystides 120-150 x 5-8-(10) µm ; basidiome jaune vif sur le frais avec marge blanche. AC sur supports très variés, parfois sur arbres vivants, à basse et moyenne altitude. 168- *Scytinostroma ochroleucum* (Bres.& Torr.) Donk var.*luteum* Boid., Gilles & Lanq. 1987

4- Spores différentes. 5

5- Spores amygdaliformes épaisses, 13-18 x 5,5-6,8 µm ; fibres de surface à ramifications frisottées, racémeuses. Sur *Hypericum lanceolatum*, Bébour.

164- *Scytinostroma crispulum* Boid., Gilles & Lanq. 1987

5- Spores fusiformes un peu courbées. 6

5- Spores fusiformes un peu courbées. 6

6- Fibres hyméniales à tendance racémeuse ; sans boucles ; spores fusiformes 13-20 x 3,2-5 µm. Sur *Rubus*, Palmistes.

167- *Scytinostroma intextum* Boid., Lanq. & Gilles 1987

6- Fibres peu ramifiées, à longs bras étalés, sinueux 7

7-Hyphes génératrices bouclées ; spores fusiformes élargies dans leur moitié supérieure, 13-16 x 4-5 µm. A basse altitude, sur *Cocos*, *Acanthophoenix* (Palmae).

169- *Scytinostroma pseudopraestans* Boid., Gilles & Lanq. 1988

7- Hyphes génératrices sans boucles ; spores fusiformes étroites, 13-18 x 2,7-3,2 µm. C au dessus de 1.000 m. sur supports divers.

165- *Scytinostroma decidens* Boid., Gilles & Lanq. 1987

I- PENIOPHORACEAE Maire 1902.

Nous avons (Boidin, Lanquetin & Gilles 1991) publié une mise au point sur les représentants tropicaux de cette famille dans laquelle sont signalées 12 espèces récoltées à la Réunion dont huit espèces nouvelles. Nous décrivions, en outre, provisoirement un *Peniophora borbonica* ad interim ; retrouvé depuis, il sera publié officiellement ci-dessous. Nous ajouterons en plus un représentant du sous-genre *Gloeopeniophora*, le *Peniophora dipyrenosperma*. Une clé des espèces récoltées à la Réunion résumera nos connaissances.

Clé des *Peniophoraceae* de la Réunion :

1- Cystides précocement brunes (genre *Duportella*). 2

1- Pas de brunissement, ou brunissement progressif de tous les éléments à partir de la base du basidiome (genre *Peniophora* sensu stricto) 6

2- Spores à face adaxiale déprimée. 3

2- Spores subovoïdes non déprimées, 5-6,5 x 3,8-4,7 µm ; sulfocystides incluses cylindriques à paroi épaissie, 35-85 x 7-20 µm, ; celles qui émergent sont fusiformes à paroi mince, parfois avec une schizopapille. Salazie II, Tévelave.

173- *Duportella miranda* Boid., Lanq. & Gilles 1991

3- Spores réniformes, 5,2-6,5 x 3,5-4,5 µm ; gloéocystides subcylindiques SA-. Roche Merveilleuse, Cilaos V. 174- *Duportella renispora* Boid., Lanq. & Gilles 1991

3- Spores cylindriques ou allantoïdes. 4

4- Gloéocystides SA- ; spores 5,2-7,5 x 2,5-3,5 µm . C à basse et moyenne altitude.

171- *Duportella kuehneri* (Boid.& Lanq.1974)Hjortst. 1987, s.d.

4- Gloéocystides SA+. 5

5- Spores 6-8 x 2,5-3 µm ; contexte horizontal nul ou très peu développé. Cilaos.

172- *Duportella kuehneroides* Boid., Lanq & Gilles 1991

5- Spores 8-12-(13) x 3-4,5-(5) µm. A basse et moyenne altitude.

175- *Duportella tristicula* (Berk.& Br.1875) Pat. 1920

6- Hyphes hyalines ou subhyalines ; basidiome clair, beige rosé, testacé ou orangé. (subgen. *Gloeopeniophora*) 7

6- Hyphes inférieures vite brunissantes ; basidiome frais rose lilacé à violet ou brun. (subgen. *Peniophora*). 10

7- Hyphes sans boucles ; petites spores ellipsoïdes ,3,5-4,5 x 2,3-2,8 µm, binucléées ; gloéocystides 20-30 x 4-5 µm, SA-. A basse altitude : Baril II, le Tremblet..

179- *Peniophora dipyrenosperma* nov.sp.

7- Boucles constantes ; spores uninucléées. 8

8- Spores cylindriques à suballantoïdes, 6-8,2 x 2,5-3,2 µm ; sulfocystides 45-65 x 10-15-(24) µm à paroi épaisse. A basse altitude.
184- *Peniophora subsalmonea* Boid., Lanq. & Gilles 1991

8- Spores ovoïdes ou oblongues, moins de 2 fois plus longues qu'épaisses ; gloéocystides SA-. C en moyenne altitude. 9

9- Spores ovoïdes à subsphériques, (3,5)-4-5-(6) x 3,2-4-(4,5) µm.
182- *Peniophora ovalispora* Boid., Lanq. & Gilles 1991

9-Spores oblongues de face, (4,5)-5-6-(7) x 3,2-4,2 µm.
183- *Peniophora scintillans* G.H.Cunn. 1955

10- Boucles constantes ; sulfocystides. 11

10- Boucles absentes ou très rares, toujours absentes au pied des basides ; gloéocystides SA-. 13

11- Sulfocystides à paroi épaisse sauf vers le sommet, 40-115 x 8-17 µm ; cystides lourdement incrustées, x 12-20 µm ; spores cylindriques à allantoïdes, (6)-6,5-8-(9,5) x 2-3 µm. C à basse altitude. 178- *Peniophora crassitunicata* Boid., Lanq.& Gilles 1991

11- Sulfocystides à paroi mince ou seulement un peu épaissie à la base. 12

12- Violacé frais, beige et fendillé avec liseré brun en herbier ; cystides profondes x 15-25 µm ; spores incurvées, 7,2-9,2 x 2,5-3,5 µm. Cilaos.
180- *Peniophora fissilis* Boid., Lanq.& Gilles 1991

12- Beige clair sur le frais ; hyphes du contexte gélifiées ; cystides pointues, les inférieures x 10-12 µm ; spores peu déprimées, 6,5-8 x 2,5-3,5 µm. En altitude.
181- *Peniophora monticola* Boid., Lanq.& Gilles 1991

13- Basides dominantes bisporiques ; spores cylindriques, (5,5)-6-8 x 2,8-3,8 µm. C à basse et moyenne altitude. 176- *Peniophora bicornis* Hjortst. & Ryv. 1984

13- Basides à 4 stérigmates ; spores subcylindriques, 8,2-10 x 2,8-3,5 µm. En moyenne altitude. (décrit mais non créé en 1991) 177- *Peniophora borbonica* nov.sp.

177- *Peniophora borbonica* nov .sp.

Peniophora borbonica ad interim, Boid., Lanq. & Gilles, Bull. Soc. Mycol. France, 107 : 130, pl. 7B, 1991.

Effusa, adhaerens, cinereorosea usque ad obscure ravam, fuscanti margine. Hyphis efibulatis, quarum basales crasse tunicatae, coalescentes, subfuscae sunt. Gloeocystidiis SA-. Multis incrustatis cystidiis, 30-60 x 8-14 µm, crasse tunicatis. Basidiis 25-37 x 5-6 µm, tetrasterigmaticis. Sporae subcylindrate, paulisper depressae sub apiculo, 7,5-9-(10) x 2,8-3,5 µm, laeves, haud amyloideae. Holotypus LY 17271. Réunion.

Etalé, adhérent, en petites taches minces puis rapidement plus épais, 200-350 µm, gris rosâtre (7,5 YR 7,5/2), à beige rosé (6/2), parfois brun plus foncé avec marge brusque. En herbier, très adhérent, écru (10 YR 7,8/3) à beige rosé (7,5 YR 7,5/2), à marge concolore sur les jeunes spécimens puis à marge brunie, pouvant, avec l'âge, se décoller légèrement.

Coupe haute de 60-330 µm avec contexte brunâtre épais de 10 à 50 µm, fait d'hyphes soudées à paroi épaissie, et zone hyméniale crassescente, épaisse, parfois stratifiée, brunie sur une grande hauteur, farcie de cystides incrustées à tous niveaux, µm, incrustée sur une grande longueur, souvent sur 30 à 50 µm. Hyphes ascendantes serrées, difficilement dissociables, à paroi épaise d'1 µm environ, dépourvues de boucles. Gloéocystides peu remarquables, x 6 µm environ, à sommet rétréci, SA- ; elles peuvent se terminer par une schizopapille. Basides subcylindriques, 25-57 x 5-6 µm à 4 stérigmates et paroi épaissie dans le tiers inférieur. Spores subcylindriques un peu déprimées sous l'apicule, souvent en S très étiré, 7,5-9-(10) x 2,8-3,5 µm, à paroi lisse, non amyloïde. ($\bar{x}$ = 8,99 ± 0,44 x 3,11 ± 0,19 pour 11550 A ; 7,85 ± 0,79 x 3,08 ± 0,18 pour le type) ; elles sont uninucléées .

Récoltes : LY 1155O A, sur *Hypericum lanceolatum*, Nez de Bœuf-85 ; 11564, sur *Acacia farnesiana*, Nez de Bœuf-85 ; 12533, Col de Bellevue-87 ;14181, sur *Fuchsia magellanica*, Col de Bellevue-90 ; 17271, holotype, sur bambou, Salazie III-98 ; 17683, sur *Ulex europaeus*, N.D. de la Paix III-99.

Caractères culturaux de 14181 : 2a-6-32-36-38-46-53-54-57 ; les mycéliums monospermes et polyspermes sont faits d'articles en grande majorité binucléés, avec quelques hyphes aux articles à 1 ou 3 noyaux.

179- *Peniophora* (subgen. *Gloeopeniophora*) *dipyrenosperma* nov.sp. Pl.3, fig. D

Jacens, roseo-gilva vel roseo-brunnea, haerens. Elementia pro parte maxima verticalia,conferta, efibulata. Cystidia numerosa, incrustata, 28-50 x 6-14 µm, hyalina, summo conico; gloeocystidia anguste clavata, 20-30 x 4-5 µm, ope SA inertia. Basidia 14-24 x 3,2-4 µm 4 sterigmatibus. Sporae ellipsoideae, 3,5-4,5 x 2,3-2,8 µm, leves, haud amyloideae, binucleatae, in massa roseae. Holotypus LY 16163. Réunion.

En petites taches arrondies puis confluentes, beige rosé (7,5 YR 7/2) à brun rosé 2,5 YR 6/4 à 5,5/3), adhérentes, à marge amincie plus pâle ou brusque et concolore. En herbier,adhérent, mat, beige écru (10 YR 7,5/3) à beige rosâtre (7,5 YR 8/4 à 7,5/4).

En coupe, il est épais jusqu'à 500 µm ; il montre alors 2 ou 3 bandes un peu brunies à mi-hauteur. A la base, très peu d'hyphes horizontales, et, très vite, éléments tous verticaux, assez serrés mais non soudés . Hyphes à cloisons simples et paroi mince ou un peu ferme, x 3-3,5-(4) µm. Très nombreuses cystides incrustées, 28-50 x 6-11-14 µm avec les cristaux, hyalines, à sommet conique ; jeunes, elles sont à paroi submince, mais celle-ci s'épaissit très vite notamment dans leur moitié supérieure. Gloéocystides peu remarquables, étroitement clavées puis subcylindriques, 20-30 x 4-5 µm, SA-. Basides 14-24 x 3,2-4 µm à 4 stérigmates. Petites spores ellipsoïdes, 3,5-4,5 x 2,3-2,8 µm, lisses, non amyloïdes, binucléées, roses en masse.
Récoltes : LY 16163, holotype, sur branche au sol, Le Tremblet-95 ; 16799, Baril II-96.

Proche de *P. ovalispora* et *scintillans*, il s'en distingue par ses spores binucléées un peu plus petites et étroites, et surtout par l'absence de boucles. L'adjectif spécifique, d'origine grecque, signifie « spores à 2 noyaux ».

Une culture polysperme a permis de confirmer l'absence de boucles.

J- REPETOBASIDIACEAE Jülich 1981 :

Genre ***Sphaerobasidium*** Oberwinkler, Sydowia 19 : 57, 1965.

Ce genre, créé pour le *Xenasma minutum* Erikss.1958 aux basides courtes, non pleurobasidiées et qui possède des cystidioles terminées en bouton, a été placé, par son créateur, dans les *Repetobasidiaceae.* Il est connu en Europe, et nous l'avons en France sur bois de conifères pourris rouges en Haute-Savoie, dans le Puy de Dôme, les Pyrénées atlantiques et les Landes. Deux autres espèces ont été décrites depuis, toutes deux sans cystidioles *: Sph.subinvisibile* Liberta 1966 du Canada sur *Picea* et *Sph.bisporum* Boid.& Gilles 1989 de la Réunion, sur palmiers. Dans sa description, il faut supprimer en bas de la page 149 le terme « cloisonnées ».

Une autre espèce réunionnaise est à ajouter, elle aussi bisporique :

186- *Sphaerobasidium gloeocystidiatum* Boid. & Gilles, nov.sp. Pl.3, fig. C

Effusum, tenue, laeve, albidum. Hyphis fibulatis ; subhymenio parum lectu facili et crystallis abundanti. Gloeocystidiis, 10-25 x 6,5-9 µm. Basidiis bisterigmaticis, brevibus 10-13 x 4-5 µm. Sporae bananiformes, 7-9 x 2,5-3 µm, laeves, haud amyloideae , binucleatae. Holotypus LY 17.724. Réunion.

Etalé, très mince, lisse, blanchâtre, à marge indifférenciée, puis un peu plus épais, blanc, continu sous la loupe,à marge amincie.

Coupe haute de 30-60 µm ; sur quelques hyphes basales, x 2-3-(3,5) µm, bouclées, aux articles courts, un sous-hyménium dense et peu lisible dans lequel des cristaux s'accumulent avec l'âge. Petites gloéocystides au contenu très gras, SA- six mois après la récolte, de formes variées, 10-25 x 6,5-9 µm, parfois subglobuleuses, souvent un peu allongées parfois avec étranglements ou encore terminées par un appendice cylindrique à paroi très réfringente. Basides bisporiques, 10-13 x 4-5 µm, bouclées ; les stérigmates sont longs de 5-7,5 µm. Spores un peu en banane, 7-9 x 2,5-3 µm à paroi lisse non amyloïde. ($\bar{x}$ = 8,05 ± 0,58 x 2,74 ± 0,19 pour le type.) ; elles sont binucléées.
Récoltes : LY 17.720, sur bois au sol, et 17.724, holotype, sur *Rubus alcaefolius*, Basse-Vallée-99.

S'il rappelle *Sph.bisporum*, il s'en distingue aisément par ses spores plus courtes et la présence de gloéocystides.

Clé générale du genre *Sphaerobasidium* :

1- Basides à 4 stérigmates. 3
1- Basides à 2 stérigmates 2
2- Spores subaciculaires, 14-19 x 2,3-3 µm ; pas de gloéocystides. Réunion.
185- *Sphaerobasidium bisporum* Boid. & Gilles 1989
2- Spores plus courtes, 7-9 x 2,5-3 µm; des gloéocystides. Réunion.
186- *Sphaerobasidium gloeocystidiatum* nov.sp.

3- Des cystidioles au sommet en bouton porteur de résine ; spores ellipsoïdes à subcylindriques faiblement déprimées, 4-5,5 x 2,5-3,5 µm. Sur conifères, Europe, Amer.N., Japon. *Sphaerobasidium minutum* (J.Erikss.1958) Oberw. ex Jülich 1979

3- Sans cystidioles ; spores naviculaires, 5,5-7 x 2,5-3 µm. Sur *Picea*, Canada. *Sphaerobasidium subinvisibile* Liberta 1966

K- TUBULICRINACEAE Jülich 1981

Le genre *Tubulicrinis* a été traité dans la note II (1986) et la note X (1988) : trois espèces y sont décrites : *T.gloeocystidiatus* Boid. & Gilles, *T.ovalisporus* Hjortst. et *T.pseudoborealis* Boid. & Gilles. Une autre espèce est à signaler,décrite de Tunisie mais signalée en de nombreux points d' Europe et d'Amérique du Nord :

187- *Tubulicrinis calothrix* (Pat.) Donk, Fungus 26 : 14, 1956 s.d.
Corticium calothrix Pat. Cat. Rais. Pl.Cell.Tunisie, 59, 1897
Peniophora calothrix (Pat.) Rogers & Jacks. Farlowia 1 : 316, 1943.

Nous ne redécrirons pas cette espèce bien caractérisée par ses cystides assez amyloïdes au canalicule élargi de manière asymétrique. Sur sporée, ses spores sont subcylindriques, non ou à peine déprimées comme sur la figure 14 f de Melo et Telleria (1992), et non allantoïdes comme dit dans les Corticiaceae of North Europe (vol.8, 1988).

Récolte : LY 16.171, sur souche morte, le Tremblet-95.

Clé des *Tubulicrinis* de la Réunion :

1- Canal des lyocystides élargi de manière progressive et symétrique 2

1- Canal élargi brusquement et de manière asymétrique; cystides amyloïdes, 80-120 x 6-8 µm; spores allantoïdes 6-7 x 1,5-1,8 µm. Le Tremblet. *Tubulicrinis calothrix* (Pat. 1897) Donk 1956

2- Spores épaisses de moins de 3,5 µm. 3

2- Spores cylindriques faiblement déprimées, 7-8-(9) x 3,75-4,2 µm; cystides 60-12O x 8-12 µm à la base, puis x 5-7 µm, enfin un peu élargies au sommet, x 6-8 µm, assez amyloïdes. Cilaos, Bellevue. *Tubulicrinis* sp. LY 12620 (1998)

3- Spores cylindriques incurvées, 6,2-8,2 x 1,2-1,7 µm; des gloéocystides 20-40 x 6-9 µm; cystides 45-140 x 7-9 µm moyennement amyloïdes. Cilaos, Bellevue. *Tubulicrinis gloeocystidiatus* Boid. & Gilles 1986

3- Spores ovoïdes ou ellipsoïdes épaisses de 2,2-3 µm 4

4- Spores ovoïdes à subamygdaliformes, 3,8-5 x 2,5-3,2 µm; cystides 30-150 x 4-7 µm non amyloïdes; basidiome finement odontioïde. Bellevue, Palmistes. *Tubulicrinis ovalisporus* Hjortst. 1981

4- Spores ellipsoïdes à subcylindriques, 4,3-6 x 2,3-3 µm; cystides étroites, sinueuses, 50-130 x 4,5-5-(6) µm, non amyloïdes. Vierge au Parasol. *Tubulicrinis pseudoborealis* Boid. & Gilles 1988

L- VUILLEMINIACEAE Maire 1902

Nous avons traité récemment du genre *Dendrothele* (Boidin, Lanquetin & Duhem 1996) et des genres *Dendrocorticium*, *Dendrodontia* et *Dentocorticium* (Boidin & Gilles 1998), qui, pourvus de dendrophyses peuvent être placés dans cette famille. Ces articles décrivent plusieurs espèces, certaines nouvelles, récoltées à la Réunion. Nous proposons simplement une clé des espèces de cette île.

1- Spores subsphériques, 19,5-27 x 18,5-25 µm à paroi finement spinuleuse dans le Melzer ou le Bleu de Crésyl ; basidiome blanc, crayeux, à marge brusque. Sur *Mangifera indica* vivant. 190-*Dendrothele mangiferae* Boid.& Duhem 1996
1- Spores à paroi lisse. 2
2- Spores a aspect pluriapiculé (5 sommets), 17-20 x 14-16 µm. Sur tronc de *Nephelium litchi* vivant, St .Philippe et sur *Cyathea*, Palmistes II-97.
188- *Dendrothele cf. asterospora* Boid. & Lanq. 1996
2- Spores au contour régulier 3
3- Basides bisporiques ; spores subelliptiques, 12-14 x 5,5-6,5 µm ; basidiome argillacé à marge brune riche en hyphes d'aspect squelettique, brunes à la base. Anses des Cascades.
189- « *Dendrothele* » *bispora* Burds. & Nakas. 1983
3- Basides tétrasporiques. 4
4- Sans leptocystides. 5
4- Des leptocystides. 8
5- Spores 10-13- (14,5) x 7-10-(12,5)µm, ovoïdes courtes. Sur bois divers à basse et surtout à moyenne altitude. 192- *Dendrocorticium ovalisporum* Boid. & Gilles 1998
5- Spores de longueur inférieure à 10 µm. 6
6- Spores subcylindriques, 7-9 x 2,8-3,8 µm ; basidiome papyracé, détachable à la traction, irrégulièrement tuberculeux à odontioïde avec marge jaune ; contexte pseudodimitique avec hyphes basales brunes à paroi épaisse, ramifiées et avec boucles espacées. En altitude : Cilaos, Tévelave.
197- *Dendrodontia bicolor* (Talbot 1948) Hjortst. & Ryv. 1980
6- Spores oblongues épaisses de 4-6 µm. 7
7- Basidiome membraneux, jaune olivacé à moutarde, riche en dépôts brunâtres et en cristaux ; spores oblongues courtes, un peu piriformes, 6-9-(10) x 4,5-6,2 µm. AC sur bois variés et même sur fougères à moyenne altitude.
195- *Dentocorticium sinapicolor* Boid., Gilles & Duhem 1998
7- Basidiome blanc ou blanc crème; dendrophyses nombreuses; spores oblongues de face, (6,5)-7,5-9-(10) x 4-6 µm. AC sur *Nastus borbonicus.*
191- *Dendrocorticium nasti* Boid. & Gilles 1998
8- Leptocystides à sommet en bouton de 6-9 µm ; spores subfusiformes, 13-17 x 5-6 µm ; basidiome beige pâle à marge blanche. Cap Noir.
193- *Dentocorticium blastanos* Boid. & Gilles 1998
8- Leptocystides plus larges près de leur base puis progressivement rétrécies. 9
9- Spores ellipsoïdes étroites, 8-12 x 2,5-3 µm. Sur *Nephrolepis bisserrata* à basse altitude. 194- *Dentocorticium nephrolepidis* Boid. & Gilles 1998
9- Spores ellipsoïdes à subcylindriques plus épaisses, 11-13-(14) x 5-6 µm ; basides utriformes. Palmistes V ; 196- *Dentocorticium utribasidiatum* Boid. & Gilles *1998*

M- *XENASMATACEAE Oberwinkler 1965*

Dans la note XV (1989) nous citons 10 espèces récoltées à la Réunion dont trois espèces nouvelles: *Aphanobasidium aurobisporum, Phlebiella nasti* et *Xenosperma pravum.* Nous allons décrire 6 autres espèces dont 4 nouvelles.

Clé des *Xenasmataceae* de la Réunion :

1- Spores ornées. 3
1- Spores lisses (genre *Aphanobasidium* Jülich 1979) 2
2- Spores amyloïdes (*A.* subgen.*Amyloxenasma* (Oberw.)Boid. & Gilles 1989) :
si spores allantoïdes, 4-6 x 2-3 µm. Cilaos, Tévelave :
198- *Aphanobasidum pruina* (Bourd. & Galz.) Boid. & Gilles 1989
2- Spores non amyloïdes (subgen. *Aphanobasidium*)
3- Des cystides et (ou) des cystidioles. *Xenasma* Donk 1957
3- Sans cystides ni cystidioles. 4
4- Spores ornées de bosses creuses, 3,8-5 x 2,2-2,7 µm ; pleurobasides à 6 stérigmates. Cilaos. 214- *Xenosperma pravum* Boid. & Gilles 1989
4- Spores ornées de petites verrues ou de petites épines. P*hlebiella* Karst.1890 ss.stricto

Aphanobasidium subgenus Aphanobasidium de la Réunion :

1- Spores sphériques, 7-9 µm. Cilaos.
203- *Aphanobasidium* aff. *canariense* (Manjon & Moreno) Boid. & Michel
1- Spores plus ou moins allongées. 2
2- Basides dominantes à 2 stérigmates ; pas de boucles. 3
2- Basides à 4-(5) stérigmates. 4
3- Spores subcylindriques un peu déprimées, 15-20 x 7-9 µm. Cilaos XII.
200- *Aphanobasidium aurobisporum* Boid. & Gilles 1989
3-Spores ellipsoïdes à subcylindriques non déprimées, à paroi un peu ferme, 9-12,2 x 4,7-6,5 µm; quelques leptocystides sphériques de 11-17 µm de diamètre.
201- *Aphanobasidium bisterigmaticum* nov.sp.
4-Spores en banane, 11-14 x 2,8-4 µm. Cilaos VI.
202- *Aphanobasidium* aff. *bourdotii* Boid. & Gilles 1989
4- Spores inférieures à 10 µm. 5
5- Spores cylindriques un peu déprimées, 4,2-5 x 2,4-2,7 µm ;rappelle *A.pruina* mais ici spores non amyloïdes. Baril. 204- *Aphanobasidium pseudopruina* nov.sp.
5- Spores plus grandes. 6
6- Spores un peu amygdaliformes, 5-6 x 3-3,7 µm.
205- *Aphanobasidium pseudotsugae* (Burt 1926) Larss.& Hjortst.1987
6- Spores dépassant 7 µm. 7
7- Spores un peu fusiformes avec apicule émergent, (6,5)-7,5-9 x 3-3,8 µm ; hyphes sans boucles ; basides larges de 6,5-8 µm. Sur *Pteridium, Cyathea*, Bellevue, Bébour, Palmistes. 204- *Aphanobasidium filicinum* (Bourd.1910) Jülich 1979
7- Spores cylindriques non déprimées , 7-8 x 3-3,5 µm à apicule peu émergent ; basides étranglées à mi-hauteur, x 5,5-6 µm, bouclées. Sur *Acanthophoenix*, Baril.
199- *Aphanobasidium acanthophoenicis nov.sp.*

***Aphanobasidium* subgenus *Amyloxenasma* (Oberw.) Boid. & Gilles, Cryptog.Bot. 1 : 75, 1989.**

198- *Aphanobasidium pruina* (Bourd. & Galz.) Boid. & Gilles 1989.

Signalé de la Réunion en 1989, cette espèce à spores amyloïdes a été retrouvée.

Récoltes : LY 14.094, 14.096 et 14.100, sur *Pteridium*, Tévelave-90.

Aphanobasidium* Jülich, Persoonia 10 : 326, 1979 subg. *Aphanobasidium

199- *Aphanobasidium acanthophoenicis* nov.sp. Pl.3, fig. E

Effusum, tenuissimum, griseoalbidum. Hyphis inaequalibus fibulatis. Tetrasterigmaticis pleurobasidiis, 13-19 x 5,5-6 µm. Sporae subcylindratae, 7-8 x 3-3,5 µm, laeves, haud amyloideae. Ad Acanthophoenicem. Holotypus 12.929.

Très mince, adhérent, blanc grisâtre à marge amincie. Hyphes à paroi mince, x 2 µm environ, irrégulières, montrant difficilement des boucles. Pleurobasides, 13-19 x 5,5-6 µm, bouclées, reserrées à mi-hauteur, à 4 stérigmates. Spores subcylindriques non déprimées, 7-8 x 3-3,5 µm, lisses, non amyloïdes.

Récolte : LY 12.929, holotype, sur *Acanthophoenix*, Baril I-87.

Proche d'*Aph. filicinum* ; il en diffère par la présence de boucles et par ses spores cylindriques à petit apicule peu proéminent.

201- *Aphanobasidium bisterigmaticum* nov.sp. Pl.4, fig. A.

Effusum, tenue, aridum, farinulentum, album. Hyphis angustis, parum separatis, efibulatis. Pleurobasidii 12-25 x 7-8 µm, bi- raro tristerigmaticis. Leptocystidiis globosis, x 11-17 µm. Sporae ellipsoideae usque ad subcylindratas, 7,5-12,2 x 4,7-6,5 µm,paulisper crasse tunicatis, laeves, haud amyloideae. Holotypus LY 14.264.

Etalé, mince, aride, adhérent, farineux, blanc. Même aspect en herbier.

Sur quelques hyphes sinueuses, étroites, x 1,5 µm environ, peu distinctes, apparemment sans boucles, naissent des basidioles serrées à base difficile à dégager ; elles montrent une tendance à la pleurobaside ; mûres elles mesurent 12-15-25 x 7-8 µm et portent 2, exceptionnellement 3 stérigmates longs de 9 µm à maturité. Quelques éléments sphériques de 11-17 µm de diamètre, à paroi un peu ferme et réfringente, sans contenu remarquable, peuvent être désignées comme des leptocystides. Spores, les plus grandes subcylindriques, les plus courtes ellipsoïdes et plus épaisses dans leur moitié supérieure ont une paroi un peu épaissie, lisse, non amyloïde ni cyanophile ; elles mesurent (7,5)-9-12,2 x 4,7-6,5 µm ($\overline{x}$ = 10,13 ± 1,10 x 5,43 ± 0,34).

Récolte : LY 14.264, holotype, sur branche morte en place . Cilaos VIII-90.

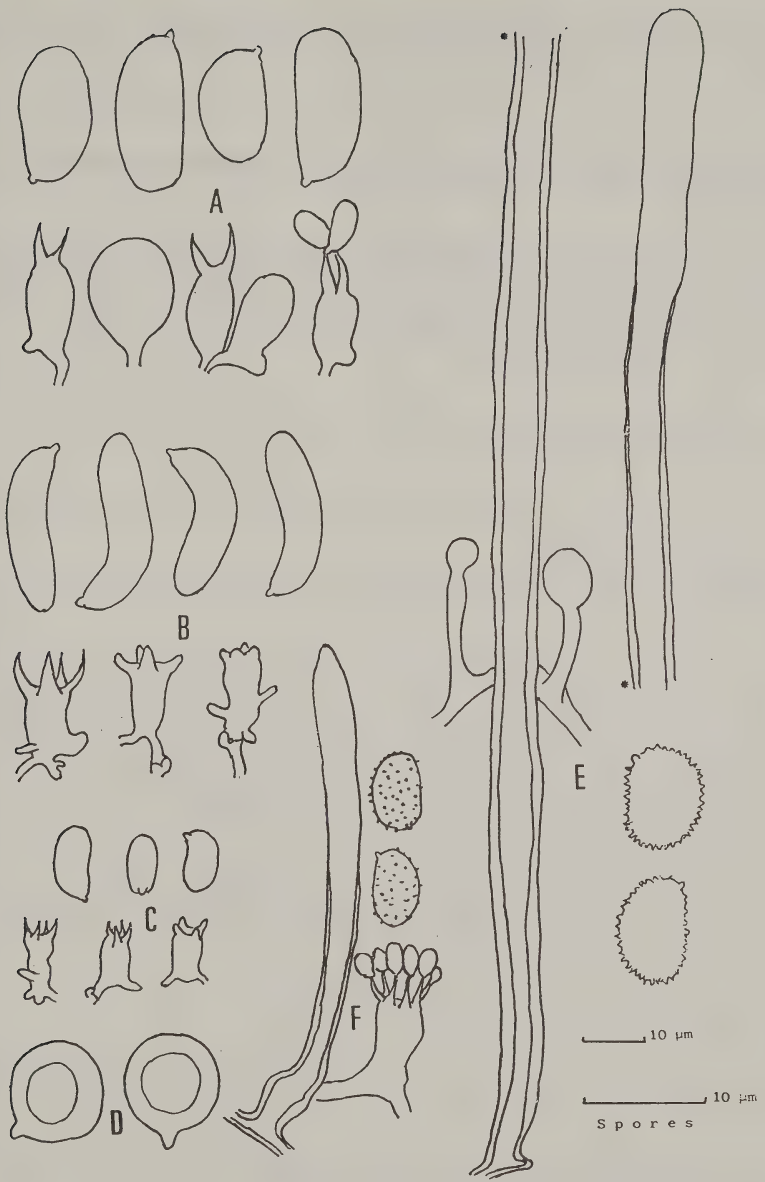

Planche 4: A- *Aphanobasidium bisterigmaticum* nov.sp. LY 14.264, holotype; B- *Aphanobasidium* aff. *bourdotii*, LY 14.322; C- *Aphanobasidium pseudopruina* nov.sp. LY 14.474, holotype; D- *Aphanobasidium* aff. *canariense*, LY 14.298; E- *Xenasma longicystidiosum* nov.sp. LY 14.113, holotype; F- *Xenasma* cf. *pruinosum*: LY 14.311 et spores de LY 17.342.

Par ses courtes basides bisporiques cette espèce rappelle le *Sphaerobasidium bisporum*, mais ici les basides ont une tendance pleurobasidiée et les spores sont très différentes.

202- *Aphanobasidium* aff. *bourdotii* Boid. & Gilles, Cryptog.Bot.1: 74, fig. 1 b, 1989

En herbier, adné, très mince, grisâtre. Hyphes tortueuses montrant difficilement des boucles. Pleurobasides 12-17 x 6-7 µm à 4 forts stérigmates, bouclées à la base, et associées à quelques hyphes un peu dendroïdes. Spores cylindriques incurvées, 11-14 x 2,8-4 µm, lisses, non amyloïdes ($\overline{x}$= 13,03 ± 0 ;85 x 3,20 ± 0,27). Pl.4, fig. B.
Récolte: LY 14.322, Cilaos VI-90.

Cette récolte rappelle l'*A.bourdotii* européen, mais a des spores plus cylindriques, un peu plus étroites et plus incurvées.

203- *Aphanobasidium* aff. *canariense* (Manjon & Moreno) Boid. & Michel, Bull. Soc. Linn. Lyon, sous presse.

= *Aphanobasidium* aff. *sphaerosporum* Boid. & Gilles, Bull. Soc. Mycol. France 105 : 154, 1989.

Après avoir décrit une espèce nouvelle française sous le nom d'*A.sphaerosporum* (Boid. & Gilles, Cryptog. Bot. 1 : 75, fig.1 s, 1989) nous avions signalé de la Réunion comme aff. *sphaerosporum* deux récoltes réunionnaises un peu différentes du type européen par son hyménium lisse et ses spores sphériques un peu plus grandes. Elle a été retrouvée : LY 14.298, Cilaos XI-90. Ses basides atteignent 30 x 14 µm et ses spores mesurent 7-9 µm de diamètre ($\overline{x}$= 8,02 ± 0,48). L'*A.sphaerosporum* d'Europe qui n'a pas l'hyménium lisse a été synonymisé récemment à l'*A.canariense*, espèce qui a des émergences parfois très distinctes, ce qui l'avait fait inclure provisoirement dans le genre *Epithele* par Hjortstam & al. (1988), puis, au vu des pleurobasides, transféré par Telleria & al. (1997) dans le genre *Phlebiella* sensu lato, dans lequel nous ne plaçons que les espèces à spores ornées, ce qui n'est pas le cas pour *Phlebiella canariensis* d'où son tranfert en cours dans le genre *Aphanobasidium*.

204- *Aphanobasidium pseudopruina* nov.sp. Pl. 4, fig. C.

Effusum, tenue. Hyphis fibulatis. Pleurobasidiis brevibus, 10-14 x 4-5 µm, tetra (interdum pente-)sterigmaticis. Sporae cylindratae, laeves, haud amyloideae, 4,2-5 x 2,4-2,7 µm. Holotypus LY 14.274.

Largement étalé, très mince, grisâtre (5 YR 8/1) . En herbier, très adhérent, à peine grisâtre (10 YR 8/2) à marge indifférenciée.

Sur quelques hyphes x 1,2-2,5 µm, agglomérées, aux articles assez courts montrant des boucles sont portées de courtes pleurobasides, 10-14 x 4-5-(6) µm à 4 et parfois 5 stérigmates. Emergent quelques hyphidies grèles, souvent sinueuses, rarement fourchues. Petites spores cylindriques un peu déprimées, lisses, non amyloïdes, 4,2-5 x 2,4-2,7 µm.

Récolte : 14.474, holotype, sur branche au sol, Baril II-90.

Cette espèce rappelle par la forme de ses spores *l'Aphanobasidium pruina* qui diffère cependant par l'amyloïdie de celles-ci. Notons que *pruina* étant un substantif et non un adjectif, reste invariable.

206- *Aphanobasidium pseudotsugae* (Burt) Boid. & Gilles, Cryptog.Bot. 1 : 75, fig. 1p, 1989.

Corticium pseudotsugae Burt, Ann.Missouri Bot.Gard. 13 : 246, 1926.
Phlebiella pseudotsugae (Burt) Larss. & Hjortst. Mycotax. 29 : 317, 1987.

Une récolte, LY 14.118, sur tronc mort debout, Tévelave-90 a des spores un peu subamygdaliformes 5-6 x 3,2-3,7 µm, donc assez petites, mais qui entrent dans la fourchette des sporées françaises citées en 1989.

Phlebiella Karst. sensu stricto.

Comme rappelé ci-dessus, nous ne plaçons dans ce genre que des espèces pleurobasidées, acystidiées, à spores spinuleuses. Deux espèces ont été signalées dans la note XV de 1989.

Clé des *Phlebiella* de la Réunion :

1- Basidiome mince, subcéracé, translucide ; spores ellipsoïdes déprimées sous l'apicule, 5-6 x 4,2-5 µm. Cilaos, Palmistes.
208- *Phlebiella tulasnelloidea* (v.Höhn. & Litsch. 1908) Oberw. 1977
1- Basidiome blanc, réticulé par des fibrilles entrecroisées ; spores subsphériques non déprimées, 4,5-5,2 x 4-4,5 µm. Sur *Nastus* et *Lantana* à basse et moyenne altitude.
207 - *Phlebiella nasti* Boid. & Gilles 1989

Xenasma Donk, Fungus 27 : 25, 1957, emend Oberw. Sydowia 19 : 39, 1965

Dans la note XV (1989) nous signalions 3 espèces à la Réunion: *X.praeteritum*, *pulverulentum* et *rimicola*. Ce dernier a été retrouvé sur branches au sol : LY 14.429, Baril II-90 et 17.386, Baril III-98, donc toujours à basse altitude dans les forêts hygrophiles du Sud-Est. Deux autres *Xenasma* ont été trouvés à la Réunion, dont une espèce nouvelle.

Clé des *Xenasma* de la Réunion :

1- Spores ellipsoïdes à côtes sublongitudinales, 7,2-14 x 4,5-10 µm. Entre 1000 et 1700 m. 212 - *Xenasma pulverulentum* (Litsch.1939) Donk 1957
1- Spores ornées de verrues ou d'épines. 2
2- Grandes cystides, 90-300 x 9-10 µm à paroi épaisse sauf vers leur sommet. Spores oblongues de face, verruqueuses, 7-8 x 5-5,8 µm. Sur *Rubus*, Tévelave.
209 - *Xenasma longicystidiatum* nov.sp.

2- Cystides inférieures à 120 µm, à paroi moins épaisse. 3

3- Basides à (3)-4 stérigmates ; spores subcylindriques, parfois faiblement déprimées, 8-11,5 x 4,5-6,5 µm finement spinuleuses. La Saline les Bains.
213 - *Xenasma rimicola* (Karst.1896) Donk 1957

3- Basides à (3)-4-6 stérigmates. 4

4-Spores ellipsoïdes, (5)-5,5-6,5 x 3-4-(4,5) µm très finement verruculeuses. En altitude : Cilaos, Salazie IV. 211 - *Xenasma* cf. *pruinosum* (Pat. 1897) Donk 1957

4- Spores oblongues, 6,5-11,5 x 5,5-8,2 µm, spinuleuses ; cystidioles à sommet en bouton. Forêts hygrophiles du Sud-Est, souvent sur *Solanum auriculatum*.
210- *Xenasma praeteritum* (Jacks.1950) Donk 1957

209- *Xenasma longicystidiatum* nov. sp. Pl.4, fig. E.

Effusum, tenuissimum, griseoalbum, saetossissimum ubi cum amplificatione perspiicitur. Hyphis basalibus jacentibus coalitis gelifactis. Pleurocystidiis 90-300 x 9-10 µm apud basim, dein cylindratis, x 6-8 µm, crasse tunicatis nisi apud summum. Cystidiolis globoso x 4-8 µm capite. Pleurobasidiis bi-, tetra-, pente-sterigmaticis. Sporae subovatae, 7-8 x 5-5,8 µm, metachromatica neque amyloidea tunica verrucis in KOH solubilibus exornata. Holotypus LY 14.113.

Etalé, très mince, blanc grisâtre, fortement sétuleux sous forte loupe. En herbier, aspect de pruine à l'œil nu, mais, sous la loupe, en pellicule contractée et hirsute.

Hyphes basales horizontales, hyalines, soudées, comme gélifiées, inséparables, à paroi mince, très peu distinctes ce qui rend l'observation des boucles très difficile. Pleurocystides devenant très grandes, 90-300 x 9-10 µm vers le bas, puis cylindriques, x 6-8 µm avec paroi épaisse jusqu'à 2,5 µm sauf dans leur partie supérieure ; les jeunes cystides sont encore à paroi mince et mesurent environ 90 x 6 µm. Cystidioles au sommet en petite boule de 4 à 8 µm de diamètre. Pleurobasides à 2-4-5 stérigmates. Spores oblongues de face, subovoïdes de profil, à face adaxiale aplanie, non déprimée, 7-8 x 5-5,8 µm à paroi un peu épaisse, très métachromatique et ornée de verrues atteignant 0,3 µm de hauteur, qui s'effacent dans KOH 3 %.

Récolte : LY 14.113, sur *Rubus alcaefolius*, holotype, Tévelave-90.

Cette espèce proche de *X.rimicola* s'en distingue par ses très grandes cystides.

211- *Xenasma* cf. *pruinosum* (Pat.) Donk, Fungus 27 : 25, 1957 ; Hjortst., Larss. & Ryv., Cort. N. Europe 8: 1595, fig. 856-857, 1988.

Corticium pruinosum Pat., Cat.Rais.Pl.Cell.Tunisie 60, 1897.

Etalé, subcéracé, très mince, grisâtre. Hyphes basales horizontales serrées, indissociables, x 2-3,5 µm, à paroi très mince ou, rarement, un peu épaissie, aux boucles présentes mais difficiles à détecter

Pleurocystides subcylindriques, 40-70-100 x 6,5-9 µm à paroi un peu épaisse de 0,5-1 µm, exceptionnellement 1,5 µm près de leur base ; elles sont souvent un peu élargies vers le haut. Pleurobasides, 15-18 x 7-7,5 µm à (4)-6 stérigmates. Spores subcylindriques à ellipsoïdes, non ou très faiblement déprimées, souvent oblongues de face, 5,5-6,3 x 3-4,5 µm ($\bar{x}$= 5,86 ± 0,25 x 3,71 ± 0,33 pour 17.342), à paroi très métachromatique et très finement verruculeuse dans le bleu de crésyl, sublisses dans le Congo ammoniacal, uninucléées. (Pl.4, fig. F).

Récoltes : 14.311, Cilaos IX-90 ; 17.342 et 17.418, sur bois au sol, Salazie IV-98.

Les cystidioles à sommet divisé n'ont pas été observées sur ces récoltes réunionnaises.

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PLEOSPORA PYRENAICA ON DRABA ASPERA RECENTLY FOUND IN YUGOSLAVIA

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Abstract

Draba aspera, growing in Mt. Prokletije (Dinaridi) was found as a new host of *Pleospora pyrenaica.* Differences among this fungal species and others previously described are discussed.

Key words: *Draba aspera*, New host, *Pleospora pyrenaica*, Mt. Prokletije, Yugoslavia.

Introduction

Pleospora pyrenaica was erected by Niessl (1876) from leaves of *Draba tomentosa* collected in High Pyrinei. One century later *P. pyrenaica* was found on other alpine Brassicaceae: *Draba aizoides*, *D. ciliaris*, *D. sauteri*, *D. pumila* and *Arabis pumila* (Wehmeyer, 1961; Crivelli, 1983) .

The great majority of *Pleospora* species develop in herbaceous stalks and leaves. The genus was monographed by Wehmeyer (1961) and emendations were later made by Eriksson (1967) and Crivelli (1983).

Infrageneric division in *Pleospora* is mainly based on spore features. Ascospores with four septa are characteristic for *P. pyrenaica.*

Material and Methods

Field samples of *Draba aspera* were collected at Maja Kolata, 2530 m, Mt. Prokletije, SE Europe, Balkan Peninsula, Yugoslavia. Plant material was preserved immediately when collected in the field. About one hundred infected leaves were selected and ascomata separated for microscopic studies. Ascomata were mounted in water, lactofenol or acid fuchsin. At least one hundred ascomata, asci and ascospores were measured.

For histological studies infected leaves were immediately placed in Bouin's fixing solution. The paraffin method (Dring, 1971) was employed in further procedures. Microtome sections 5-8 µm thick were stained with safranin. Sections were mounted in Canada balsam. Reproductive structures were drawn and photographed using a microscope Leica DMRB.

Descriptions and remarks

Ascomata visible externally as scattered black spots at the margin of the leaves, separate, solitaries or arranged in groups, spherical, subepidermal, intermingled with the plant hairs, smooth, 112-185 µm in diameter, with papilla about 50 µm in diameter and up to 32 µm high (Figs. 1-4). Peridium wall with an external layer of textura angularis, brown, completely occluded by the melanin deposits, and an inner layer of sometimes compressed dark brown thick-walled pseudoparenchymatic fungal cells. Pseudoparaphyses not visible in mature ascomata. *Asci* 56.2-83.2 x 16.2-18.7 µm, clavate with stalk 6.0-25.0 x 5.0 µm, apex rounded, with eight ascospores (Figs. 5-8). *Ascospores* uniseriate, 18.0-22.5 x 8.9-11.3 µm, with 4 transversal septa (two above and one below the primary septum) and one vertical septa, dark brown, rounded at both ends (Figs. 9, 10).

Anamorph - *Stemphylium* state of *Pleospora pyrenaica* (Fig. 11).

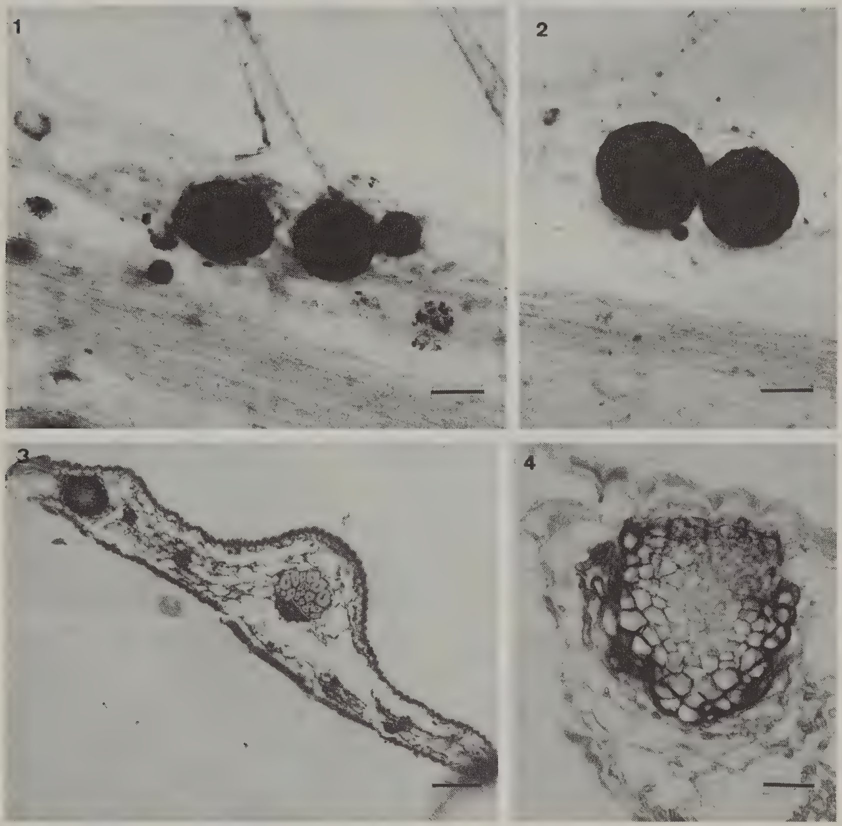
Host species: *Draba aspera* Bertol.

Specimen studied: Montenegro, Maja Kolata (Mt. Prokletije), 2530 m, on leaves of *Draba aspera*, 5 July 1995, Stevanović, V., Lakušić, D., Niketić, M., Bulić, Z., Hadžiablahović, S. 751/95 (BEOU! - Botanical Institute and Garden, Faculty of Biology, University of Belgrade).

Other material examined: 1) Jelica Mt., Košanin, BEOU!, 1875 ; 2) Ćirova Pećina cave (Durmitor Mt.), Košanin, BEOU!, 1912; 3) Stožina - Vražje Jezero lake (Durmitor Mt.), Sevanović *et al.*, BEOU!, 1991; 4) Sedlo-Bobot, Bobotov Kuk top (Durmitor Mt.), Jovanović *et al.*, BEOU!, 1991; 5) Veliki Medjed top (Durmitor Mt.), Lakušić, BEOU!, 1992; 6) Bobotov Kuk top (Durmitor Mt.), Lakušić *et al.*, BEOU!, 1996; 7) Prokletije Mt., Sevanović *et al.*, BEOU!, 1995.

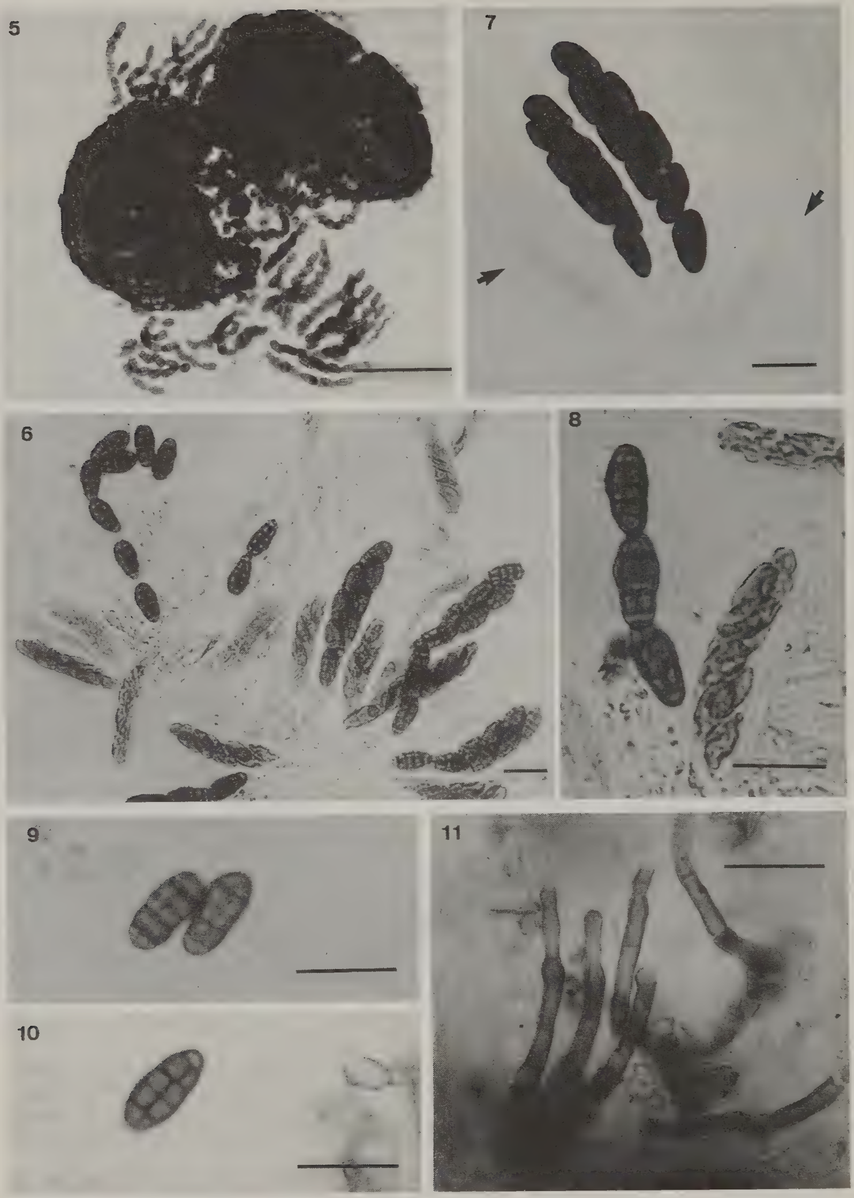
Within the genus *Pleospora* there are many variations and overlapping series of individual collections, which make the circumscription of species difficult in many cases. According to Wehmeyer (1961) the genus is broken up into subgenera, sections, and series upon this basis. *Pleospora pyrenaica* belongs to the subgenus *Pleospora*, section *Leptosphaerioides*, series II. The large and heterogeneous subgenus *Pleospora* includes the main lines of evolution, with many interlocking series which do not show the sharp distinctions of the other subgenera. The series II, besides *P. pyrenaica*, includes species *P. curvasca*, *P. mollis*, *P. rudis*, *P. asperulae*, *P. spartium-junci* and *P. lactuciola*. The species most similar to

P. pyrenaica is *P. rudis*, having ascospores with 4 transversal septa (Wehmeyer, 1961). These two species differ each other in the position of transversal septa in relation to the position of the primary septum. In *P. rudis* one septum is above and two below the primary septum, while in *P. pyrenaica* two septa are above and one below the primary septum.



Figs. 1-4. Ascomata on the host. Figs. 1, 2. Ascomata at the margin of the leaves, among the hairs of the host. Figs. 3, 4. Cross section through the leaves of *Draba aspera*, ascomata between the surface and reverse epidermis. Scale bars: 1-3 = 100 μm; 4 = 20 μm.

P. pyrenaica on *Draba aspera* shows variation in size of ascomata, asci and ascospores when compared with those of the same species described on other hosts (Table 1). From these data it must be concluded that the fungal species found on *D. aspera* in Mt. Prokletije fits well to the descriptions of *P. pyrenaica* on other hosts.



Figs. 5-11 Light micrographs of *Pleospora pyrenaica*. Fig. 5. Ascomata with asci. Fig. 6. Asci. Figs 7, 8. Mature asci with ascospores and young asci without ascospores (arrows). Figs. 9, 10. Ascospores. Fig. 11. Conidiophores of the *Stemphylium* state of *Pleospora pyrenaica*. Scale bars: 5 = 100 µm; 6-11 = 20 µm.

Table 1. Comparisons of reproductive structures of different isolates of *Pleospora pyrenaica* (in µm).

	Niessl (1876)	Wehmeyer (1961)	Crivelli (1983)	Our results (1999)
Host	*D. tomentosa*	*D. aizoides* *D. pumila*	*D. aizoides* *D. sauteri, D. ciliaris*	*D. aspera*
Ascomata	160-190	200	100-230	112-185
Asci	60-70 x 15-17	70-78 x 14-17	50-100 x10.5-13.5	56.2-83.2x16.2-18,7
Ascospores	18-20 x 10	15-17.5 x 5-8.5	18-22 x 8-9.5	18.8-22.5 x 8.9-11.3

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PRELIMINARY SURVEY OF DISCOMYCETES FROM THE CHANGBAI MOUNTAINS, CHINA*

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Abstract Forty-six discomycetes of thirty genera belonging to twelve different families are found in the Changbai Mountains. Among them, *Albotricha changbaiensis* and *Scutellinia jilinensis* are described as new taxa. *Albotricha minuta*, *Cistella geelmuydenii*, *Dasyscyphella dryina*, *Hamatocanthoscypha uncipila*, *Holwaya mucida* subsp. *nipponica*, *Hymenoscyphus* cf. *lutescens*, two taxonomic species of *Hymenoscyphus*, and *Lachnum* cf. *salicarine* are reported for the first time from China.

Key words Taxonomy; *Albotricha changbaiensis*; *Scutellinia jilinensis*

The Changbai Mountains, located in the north of China, are among the most valuable reserves in China for various natural ecosystems. There are four vegetation zones arranged from lower to higher elevations in the mountains. The broadleaf tree – Korean pine mixed forests are at the elevations below 1100 m and coniferous forests distributed between 1100 m and 1700 m; the Erman's birch forest extends from 1700 m to 2000 m; and the alpine tundra is above 2000 m. Affected by the monsoons, the region features a temperature continental mountainous climate, where the mean annual temperature ranges from –7.3 C to 4.9 C. The mean annual precipitation varies from 600 mm to 1340 mm. A recent expedition to the Changbai Mountains was organized in September, 1998. Areas surveyed were at the elevations of 750-2000 m, where about 100 discomycete specimens were collected. Previous collections on deposit in the Mycological Herbarium, Institute of Microbiology, Academia Sinica (HMAS) were also examined. Forty-six taxa of 30 genera belonging to the Dermateaceae, Geoglossaceae, Helotiaceae, Helvellaceae, Hyaloscyphaceae,

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Leotiaceae, Orbiliaceae, Otideaceae, Pezizaceae, Sarcoscyphaceae, Sarcosomataceae, and Sclerotiniaceae were recognized. *Albotricha changbaiensis* and *Scutellinia jilinensis* are treated as new species. New records for China which are marked with an asterisk (*) are in the genera *Albotricha* Raitv., *Cistella* Quél., *Dasyscyphella* Tranzschel, *Hamatocanthoscypha* Svrcek, *Holwaya* Sacc., *Hymenoscyphus* Gray, and *Lachnum* Retz.

Albotricha changbaiensis W.Y. Zhuang & Z.H. Yu, **sp. nov.** (Fig. 1) 长白白毛盘菌

Ab *Albotricha kurilensi* apotheciis minutis, 0.2-0.3 mm diam; ascis 63-72 x 6-7 μm; ascosporis nonseptatis, 12-18 x 2-2.7 μm differt.

Apothecia deeply cupulate, stipitate, 0.2-0.3 mm in diam, hymenium light orange-yellow, receptacle whitish, surface hairy. Hairs aciculate, hyaline, 5-9-septate, 140-180 μm long, 2.5-4.2 μm wide in the middle and at base, 1-1.5 μm wide at the apex, walls smooth to slightly roughened. Ectal excipulum of *textura prismatica*, 35-58 μm thick; cells hyaline, thin-walled, 5-18 x 2.5-5.5 μm. Medullary excipulum of *textura intricata*, 20-71 μm thick; hyphae 2.5-4 μm wide. Hymenium 76-85 μm thick. Asci 8-spored, clavate, conical at the apex, J+, pore walls blue in Melzer's reagent, 63-72 x 6-7 μm. Ascospores elongate-ellipsoid to cylindrical-ellipsoid, non-septate, irregularly biseriate, multiguttulate, with guttules arranged in a row, 12-18 x 2-2.7 μm. Paraphyses lanceolate, 3.5-4.5 μm wide at the widest, exceeding the asci by 10-17 μm.

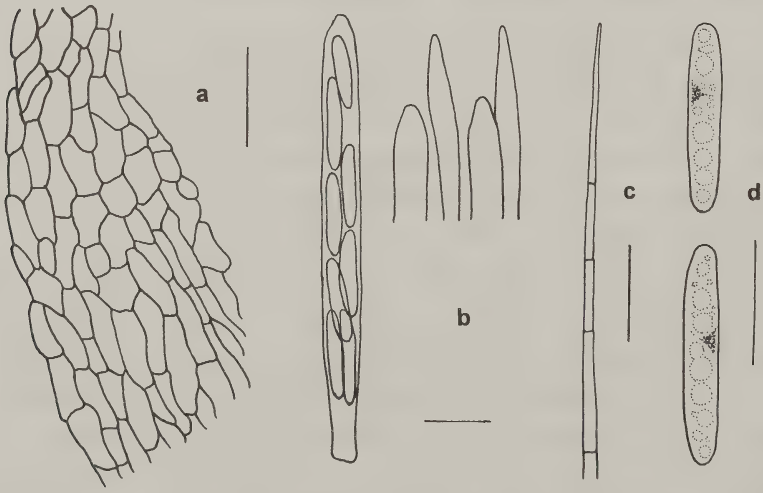

Fig. 1. *Albotricha changbaiensis*: **a**. Ectal excipulum near margin; **b**. An ascus with ascospores and apices of asci and paraphyses; **c**. A fragment of hair; **d**. Ascospores. **a**, **c** scale = 20 μm; **b**, **d** scale = 10 μm. From holotype.

Holotype: On stems of a monocotyledon, Changbai Mountains, Jilin, China, alt. 1000 m, S.L. Chen & W.Y. Zhuang 2631, 11 IX 1998, HMAS 75526.

Albotricha was segregated from *Lachnum* by Raitviir (1970). It contains about 23 species and is characterized by presence of aciculate, smooth to slightly roughened, septate hairs, and lanceolate paraphyses (Raitviir, 1970, 1973, 1981, 1985, 1991; Zhuang, 1998). Among the existing species, *A. changbaiensis* is similar to *A. kurilensis* Raitv. in spore shape and size but differs from the latter in smaller apothecia (0.2-0.3 mm *vs*. 0.5-1.5 mm in diam), slightly larger asci (63-72 x 6-7 μm *vs*. 61-63 x 5.8-6.0 μm), larger (12-18 x 2-2.7 μm *vs*. 12.3-12.9 x 2.0-2.4 μm) and non-septate instead of 1-septate ascospores.

* ***Albotricha minuta*** Raitv., Fl. Crypt. Est. Fasc. 2:14, 1973. 小白毛盘菌

Apothecia discoid, stipitate, 0.3-0.6 mm in diam, hymenium white, receptacle concolorous, surface hairy. Hairs, aciculate, up to 135 μm long, 3-4 μm wide at the base, 1-1.5 μm wide at the apex, smooth and thin-walled, hyaline, septate. Ectal excipulum of *textura prismatica*. Medullary excipulum of *textura intricata*. Asci 8-spored, J+ in Melzer's reagent, 40-43 x 4-4.5 μm. Ascospores elongate-ellipsoid, with small guttules, hyaline, 7-9.5 x 1.7 μm. Paraphyses lanceolate, 2.5-3.0 μm wide, exceeding the asci by 10-13 μm.

On hard wood. HMAS 75528.

Compared with the East Siberia and Far East materials (Raitviir, 1973), hairs of the Chinese collection are wider (3-4 μm wide at base and 1-1.5 μm wide at apex *vs*. 123-125 x 2.0-3.2 μm) and ascospores longer (7-9.5 x 1.7 μm *vs*. 6.6-7.6 x 1.8-2 μm).

Ascocoryne cylichnium (Tul.) Korf, Phytologia 21(4): 202, 1971.

On wet rotten wood. HMAS 77974, 77975, 77976, 77977, 77978, 77979, 77980, 77981, 77982.

Ascospores of HMAS 77980 are longer (up to 34 μm long) than those in other specimens examined and recorded from the British material (Dennis, 1978).

Ascocoryne sarcoides (Jacq.) J.W. Groves & D.E. Wilson, Taxon 16: 40, 1967.

On rotten wood. HMAS 77983.

Bisporella citrina (Batsch: Fr.) Korf & S.E. Carp., Mycotaxon 1: 58, 1974.

On wood. HMAS 77984, 77985, 77986, 77987, 77988, 77989, 77990, 77991.

Bulgaria inquinans (Pers.: Fr.) Fr., Syst. Mycol. 2: 167, 1882.

On mossy wood. HMAS 29540.

Calycellina populina (Fuckel) Höhn., Akad. Wiss. Wien. Sitz., Math.-Nat. Kl., Abt. I. 127: 601, 1918.

On leaves. HMAS 77992.

Apothecial surface of our fungus is concave instead of convex as indicated by Lowen & Dumont (1984). This collection is slightly different from the British material in hairs hyphoid and 0-1-septate instead of delicate and tapering to a rounded tip (Dennis, 1949).

Catinella olivacea (Batsch) Boud., Hist. Class. Discom. Eur. p. 150, 1907.

On wet rotten wood. HMAS 77993.

Chlorociboria aeruginascens (Nyl.) Kanouse ex C.S. Ramamurthi, Korf & L.R. Batra, Mycology 49: 858, 1958.

On rotten wood. HMAS 29541, 29542, 77995, 77996, 77997, 77998.

Chlorociboria aeruginosa (Pers.: Fr.) Seaver ex C.S. Ramamurthi, Korf & L.R. Batra, Mycologia 49: 859, 1958.

On hard wood. HMAS 77999.

* ***Cistella geelmuydenii*** Nannf., Nova Acta Regiae Soc. Sci. Upsal. IV. 8(2): 270, 1932. 吉氏小毛盘菌

Apothecia discoid, sessile, 0.2-0.4 mm in diam, hymenium and receptacle white when fresh, receptacle surface pubescent to downy. Hairs clavate, obtuse to hemispherical at the apex, straight, loosely granulate at the apex, hyaline, septate, 15-30 µm long, up to 4 µm at the upper portion, 2-3 µm wide below. Ectal excipulum of *textura angularis*, cell walls glassy. Medullary excipulum of *textura intricata*. Hymenium 38-52 µm thick. Asci 8-spored, clavate, J– in Melzer's reagent, 28-45 x 5.4-6 µm. Ascospores ellipsoid to elongate-ellipsoid, irregularly biseriate, biguttulate, 5-6.2 x 2 µm. Paraphyses filiform, 1 µm wide.

On rotten wood. HMAS 77994.

Asci of this collection are longer than described by Nannfeldt (1932).

* ***Dasyscyphella dryina*** (P. Karst.) Raitv., Scripta Mycol. 1: 72, 1970. 槲小毛钉菌

Apothecia discoid, stipitate, 0.8-2 mm in diam when dry, hymenium greenish yellow when fresh, dirty yellow when dry, receptacle white, hairy. Hairs cylindrical, slightly wider at apex, apical cell smooth-walled, other cells roughened, hyaline to subhyaline, mostly 3-septate, 95-135 x 2-2.5 µm. Ectal excipulum of *textura prismatica*. Medullary excipulum of *textura intricata*. Hymenium 80-100 µm thick. Asci 8-spored, clavate, J+ in Melzer's reagent, 67-80 x 5-7 µm. Ascospores elongate-ellipsoid to fusiform, uniseriate to irregularly uniseriate, with a few small guttules, unicellular, becoming 1-septate before or at germination, 8-12 x 2-3 µm. Paraphyses filiform, 1.5-2 µm wide.

On hard wood. HMAS 75525.

Galiella amurensis (Lj.N. Vassiljeva) Raitv., Izv. Akad. Nauk. Estonsk. SSR. Biol. 14 (4): 531, 1965.

On wood. HMAS 33645, 56653, 72176.

* **Hamatocanthoscypha uncipila** (Le Gal) Huhtinen, Karstenia 29: 201, 1990. (Fig. 2)
钩毛钩刺盘菌

Apothecia discoid, short-stipitate, 0.15-0.3 mm in diam, hymenium greenish yellow when fresh, pale yellow when dry, receptacle concolorous, surface hairy. Hairs subcylindrical with a curved apex, slightly narrowed apically and somewhat wider below, hyaline, thin-walled, 0(-1)-septate, walls smooth to slightly roughened, less than 25 µm long, 1.5-2 µm wide in upper portion, up to 2.5-3 µm wide at base. Ectal excipulum of *textura angularis* to *textura prismatica*, 30-38 µm thick. Medullary excipulum of *textura intricata*, 45-55 µm thick. Hymenium 46-50 µm thick. Asci 8-spored, clavate, J– in Melzer's reagent, 35-53 x 5-6 µm. Ascospores ellipsoid, 0(-1)-septate, hyaline, with 2-3 medium-sized guttules or many tiny ones, 5-8.5 x 1.5-2.7(-3) µm. Paraphyses subcylindrical to filiform, slightly enlarged at the apex, non-septate, 1.5-2 µm wide.

On rotten twig. HMAS 75527.

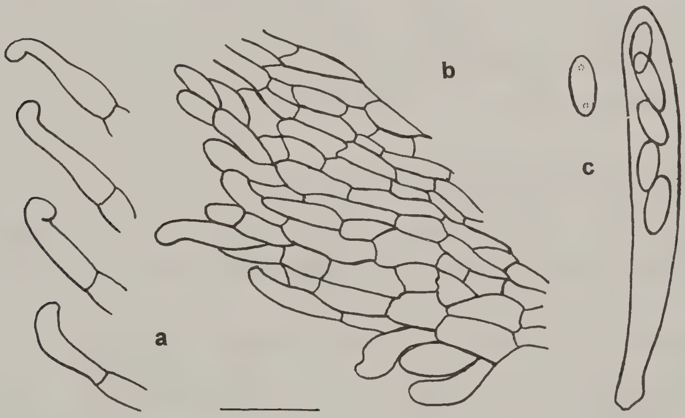

Fig. 2. *Hamatocanthoscypha uncipila*: **a**. Hairs; **b**. Ectal excipulum at upper flank; **c**. An ascus and ascospores. Scale = 10 µm. From HMAS 75527.

Helvella macropus (Pers.: Fr.) P. Karst., Not. Sällsk. Fauna Fl. Fenn. Förh. 11: 224, 1870.

On the ground. HMAS 28252, 78000.

Helvella crispa (Scop.: Fr.) Fr., Syst. Mycol. 2: 14, 1823.

On the ground. HMAS 63448.

* ***Holwaya mucida*** (Schulzer) Korf & Abawi subsp. ***nipponica*** Korf & Abawi, Can. J. Bot. 49: 1881, 1971. 霉霍氏盘菌日本亚种

Apothecia discoid, stipitate, 5-8 mm in diam, stipe 1-8 mm high, hymenium black when fresh, receptacle concolorous, with pustules on surface. Ectal excipulum of *textura angularis*, 38-76 μm thick (including pustules); cells globular, brownish, thick-walled. Medullary excipulum of *textura intricata*, 400-450 μm thick; hyphae brownish. Subhymenium 38-50 μm thick. Hymenium 152-165 μm thick. Asci 8-spored, elongate-clavate to subcylindrical, somewhat thickened at apex, J– in Melzer's reagent, 150-187.5 x 11-12.5 μm. Ascospores filiform, with the lower end narrower, (7-)10-20(-30)-septate, multiguttulate, arranged in a fascicle, (78.5-)96-114.5 x 2.5-3 μm. Paraphyses filiform, curved at apex, ca 1 μm wide.

On rotten wood. HMAS 75549.

Humaria hemisphaerica (F.H. Wigg.: Fr.) Fuckel, Jahrb. Nass. Vereins Naturk. 23-24: 322, 1870.

On the ground. HMAS 78001.

Hyaloscypha cf. ***albohyalina*** (P. Karst.) Boud., Hist. Class. Eur. p. 127, 1907.

On rotten wood. HMAS 78003.

Our collection differs from *Hyaloscypha albohyalina* (Huhtinen, 1990) in ectal excipulum of *textura angularis* instead of *textura prismatica*, and asci J–, pore walls not blue in Melzer's reagent.

Hyaloscypha aureliella (Nyl.) Huhtinen, Karstenia 29: 107, 1990.

On rotten wood. HMAS 78004.

This collection has smaller hairs [36 x 2.5 μm *vs*. 25-60(-110) x 2.5-5.2(-7.8) μm] and tiny guttules which are not as obvious as indicated by Huhtinen (1990).

Hymenoscyphus immutabilis (Fuckel) Dennis, Persoonia 3: 76, 1964.

On rotten leaves of tree. HMAS 78006, 78007, 78008, 78009, 78010.

Among specimens examined, HMAS 78010 is different from that described by Dennis (1956) and Lizon (1992) in ascus iodine reaction which is J– instead of J+ in Melzer's reagent.

* ***Hymenoscyphus*** cf. ***lutescens*** (Hedw.: Fr.) W. Phillips, Brit. Discom. p. 131, 1887. (参照)土黄膜盘菌

On pine needles. HMAS 78011.

As reported by Dennis (1956), apothecia of *Hymenoscyphus lutescens* are reddish-brown when dry, asci J+ in Melzer's reagent and ascospores occasionally 1-septate, which is not the case in our collection. Apothecia of HMAS 78011 are white when fresh and orange when dry. Ascospores are non-septate, narrower, 9-12 x 2.5-3.5 µm *vs*. 10-15 x 3-4 µm (Dennis, 1956) and 11.7-14.3 x 4.2-5.2 µm (Lizon, 1992).

Hymenoscyphus scutulus (Pers.: Fr.) W. Phillips var. ***solani*** (P. Karst.) Ahmad, Ascom. Pakistan I: 207, 1978.

On herbaceous stems. HMAS 78013.

This collection is different from the British material (Dennis, 1956) in asci J– in Melzer's reagent.

Hymenoscyphus cf. ***scutulus*** (Pers.: Fr.) W. Phillips var. ***solani*** (P. Karst.) Ahmad, Ascom. Pakistan I p. 207, 1978. (Fig. 3a)

Apothecia cupulate, stipitate, 0.25-0.6 mm in diam, hymenium dirty white to slightly gray when fresh, yellowish when dry. Ectal excipulum of *textura prismatica*. Medullary excipulum of *textura intricata*. Asci 8-spored, clavate, tapered to a long and fine tail at base, J– in Melzer's reagent, 95-127 x 7-9 µm. Ascospores filiform, 1-septate, sometimes slightly curved, with 2-4 large guttules, irregularly biseriate, 17.5-21 x 3-4 µm. Paraphyses filiform, 1.5-2.0 µm wide in the middle and 2.5-3.0 µm wide at the apex.

On stems of a monocotyledon. HMAS 78014.

Compared with *Hymenoscyphus scutulus* var. *solani*, this collection has longer asci (95-127 x 7-9 µm *vs*. 80-85 x 10 µm) and ascospores [17.5-21 x 3-4 µm *vs*. 16-18 (-20) x 3.5-4 µm]. Asci are J– in Melzer's reagent instead of J+ as recorded in the British material (Dennis, 1956).

Hymenoscyphus taxonomic sp. #1 (Fig. 3b)

Apothecia discoid, long-stipitate, up to 0.9 mm in diam, stipe up to 11 mm long; hymenium white when fresh, yellowish when dry. Ectal excipulum of *textura prismatica*. Medullary excipulum of *textura intricata*. Asci 8-spored, clavate, arising from croziers, J+ in Melzer's reagent, 120-140 x 10.5-12 µm. Ascospores narrowly scutuloid, non-ciliate, 0-1-septate, multiguttulate, hyaline mostly, a few becoming faintly colored when fully mature, irregularly biseriate, 36-45 x 4-5.2 µm. Paraphyses filiform, 1.5-2 µm wide.

On herbaceous stems. HMAS 78005.

Compared with taxa in a few genera which possess scutuloid ascospores, such as *Hymenoscyphus caudatus* (P. Karst.) Dennis, *H. dearnessii* (Ellis & Everh.) Kuntze, *H. fucatus* (W. Phillips) Baral & Krieglst., *H. scutulus, Lambertella albida* (Gillet) Korf, *Lambertella caudatoides* W.Y. Zhuang, *Lambertella torquata* W.Y. Zhuang, *Lanzia serotina* (Pers.: Fr.) Korf & W.Y. Zhuang, and *Lanzia microserotina* W.Y. Zhuang, HMAS 78005 is characterized by its much longer spores and very long-stipitate apothecia. *H. dearnessii* (White, 1944) is the closest species but has different spore size (30-35 x 4-4.5 µm) and sessile apothecia. The fungus is certainly uncommon and possibly represents a new taxon, unfortunately, the material contains few apothecia and is too poor to be a type. We thus report it as *Hymenoscyphus* taxonomic sp. #1.

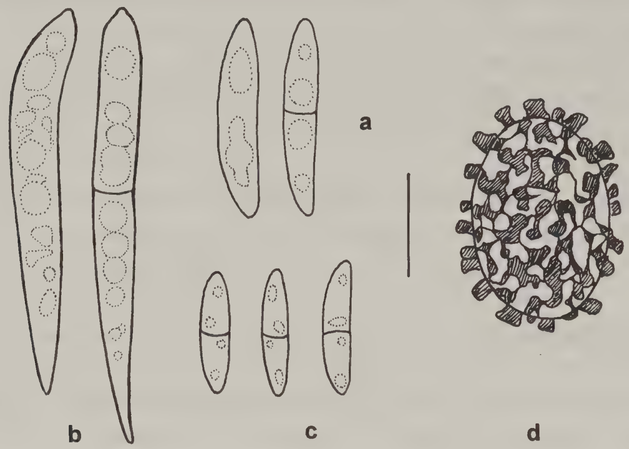

Fig. 3. *Hymenoscyphus* spp. and *Scutellinia jilinensis*: **a**. Ascospores of *Hymenoscyphus* cf. *scutulus* var. *solani*, from HMAS 78014; **b**. Ascospores of *Hymenoscyphus* sp. #1, from HMAS 78005; **c**. Ascospores of *Hymenoscyphus* sp. #2, from HMAS 78012; **d**. Ascospore of *Scutellinia jilinensis*, from holotype. Scale = 10 µm.

Hymenoscyphus taxonomic sp. #2 (Fig. 3c)

Apothecia discoid, stipitate, 0.1-0.2 mm in diam, translucent-whitish when fresh. Ectal excipulum of *textura angularis*. Medullary excipulum of *textura intricata*. Asci 8-spored, cylindrical, J– in Melzer's reagent, 50-65 x 6.5-8 µm. Ascospores fusiform, 1-septate, multiguttulate or with 4 medium-sized guttules, irregularly biseriate, 9-14 x 2-3 µm. Paraphyses filiform, 2-2.5 µm wide.

On stems of a monocotyledon. HMAS 78012.

This collection is somewhat similar to *H. nitidulus* (Berk. & Broome) W. Phillips on dead grass, nevertheless, apothecia of our fungus are obviously stipitate, whitish, and translucent instead of short-stipitate to almost sessile, pale pinkish buff in *H. nitidulus*, and pore walls of asci are J- in Melzer's reagent instead of J+.

Lachnellula subtilissima (Cooke) Dennis, Persoonia 2: 183, 1962.

On conifer twig. HMAS 75529, 78016.

* ***Lachnum*** cf. ***salicariae*** (Rehm) Raitv., in Azbukina (ed.) Plantae non Vascul., Fungi Bryops. Orient. Extr. Soviet., Fungi. Ascom. 2: 293, 1991.（参照）千曲菜粒毛盘菌

Apothecia discoid, stipitate, 0.3-0.4 mm in diam, hymenium cream, receptacle white, surface hairy. Hairs subcylindrical, slightly swollen at the apex, granulate, hyaline, 2-4-septate, 34-60 x 3-3.5 µm. Ectal excipulum of *textura prismatica*, cell walls glassy. Medullary excipulum of *textura intricata*. Hymenium ca 45 µm thick. Asci 8-spored, subcylindrical, J– in Melzer's reagent, (37) 40-50 x 4-5 µm. Ascospores elongate-fusiform to allantoid, biseriate to irregularly biseriate, guttulate, hyaline, 6.5-8 x 1.2-1.5 µm. Paraphyses lanceolate, 1.5-2 µm wide, exceeding the asci by 3-8 µm.

On straw. HMAS 78017.

This fungus is different from *Lachnum salicariae*. Apothecia are on straw instead of on *Lythrum salicaria*, asci are larger (40-50 x 4-5 µm *vs.* 30-40 x 4 µm) and hairs are 2-4-septate instead of 1-3-septate.

Lanzia serotinus (Pers.: Fr.) Korf & W.Y. Zhuang, Mycotaxon 22: 506, 1985.
On duff. HMAS 78015.

Leotia lubrica Pers., Mycol. Eur. 1: 201, 1822.
On duff. HMAS 78018.

Orbilia inflatula (P. Karst.) P. Karst., Not. Sällsk. Fauna Fl. Fenn. Förh. 11: 248, 1870.
On wet wood. HMAS 75523, 78019.

Otidea leporina (Batsch) Fuckel, Jahrb. Nass. Vereins Naturk. 23-24: 329, 1870.
On the ground. HMAS 28257, 29549.

Otidea onotica (Pers.: Fr.) Fuckel, Jahrb. Nass. Vereins Naturk. 23-24: 329, 1870.
On the ground. HMAS 28258, 29550.

Peziza phyllogena Cooke, Mycographia 1: 148, 1887.
On mossy wood. HMAS 78023.

Psilachnum chrysostigmum (Fr.) Raitv., Scripta Mycol. 1: 104, 1970.
On fern. HMAS 78025.

Ascospores of this collection are shorter than described by Raitviir (1970) (5-6 x 1-1.5 µm *vs.* 5-9 x 1 µm).

***Sarcoscypha* sp.**
On rotten twig. HMAS 78026.

Anatomic structure of apothecia indicates that it is a species of *Sarcoscypha* (Fr.) Boud. but the material is too young to see ascospores.

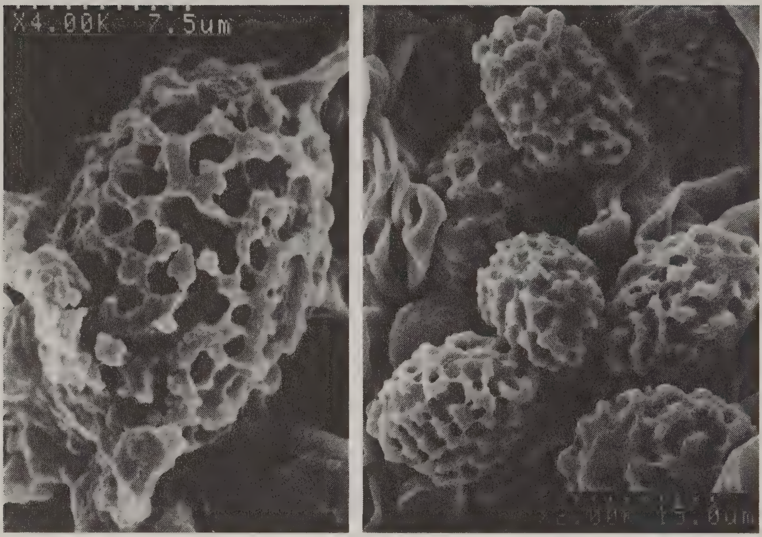

Fig. 4. SEM photographs of *Scutellinia jilinensis*: left from holotype, scale = 7.5 μm; right from HMAS 61452, scale = 15 μm.

Scutellinia crinita (Bull.: Fr.) Lambotte, Fl. Mycol. Belge. Suppl. 1: 301, 1887.

On mossy wood. HMAS 78027.

Spore markings of our fungus are isolated warts, 0.3-0.5 μm high and 0.5-0.8 μm in diam.

Scutellinia jilinensis Z.H. Yu & W.Y. Zhuang, **sp. nov.** (Figs. 3d, 4) 吉林盾盘菌

Ab *Scutellinia chiangmaiensi* ascosporis anguustis, 18.5 x 11-12.7 μm; tuberculis ascosporarum minusculis, demissis, 1-1.6(-2) x 1 μm differt.

Apothecia discoid, 5-8 mm in diam, hymenium orange to dirty orange-red, margin and receptacle hairy. Hairs setaceous, not densely distributed, with 2-5 rootlets, tapering to the apex, 20-48 μm wide and 70-1900 μm long, septate, brown and thick-walled. Ectal excipulum of *textura angularis*, 250-300 μm thick; cells globose to ellipsoid, brownish, slightly thick-walled, 30-96 μm in diam if isodiametric, or 27-108 x 22-88 μm. Medullary excipulum of *textura intricata*, 165-200 μm thick. Subhymenium 50-65 μm thick. Hymenium 243-260 μm thick. Asci 8-spored, subcylindrical, J– in Melzer's reagent, 225-266 x (15-)17-20 μm. Ascospores ellipsoid, with markings on surface, multiguttulate, some with a de Bary bubble, uniseriate, 15-19 x 10-12.7 μm excluding the markings; warts isolated or incompletely interconnected by fine ridges, more or less truncate, 1-2 μm high, 1-2.5 μm wide. Paraphyses cylindrical, septate, enlarged at the apex, 7-9 μm wide at apex and 3.5-5 μm below.

Holotype: On mossy wood, Changbai Mountains, Jilin, China, alt. 760 m, S.L. Chen & W.Y. Zhuang 2536, 10 IX 1998, HMAS 78040.

Paratypes: on the wood, Jiaohe Forestry Station, Jilin, China, alt. 800 m, W.Y. Zhuang 756, 28 VIII 1991, HMAS 61451; on wet wood, Jiaohe, Jilin, China, alt. 550 m, W.Y. Zhuang 789, 31 VIII 1991, HMAS 61452.

Among the existing species of *Scutellinia* (Cooke) Lambotte (Cao & Moravec, 1988; Moravec, 1989; Schumacher, 1990; Häffner, 1993; Yao & Spooner, 1995; Liu, 1996; Moravec, 1996; Zhuang & Wang, 1998), *Scutellinia jilinensis* is similar to *S. chiangmaiensis* T. Schumach., *S. cubensis* (Berk. & M.A. Curtis) Gamundí, and *S. fujianensis* J.Z. Cao & J. Moravec in spore shape and size and the relatively large spore markings. When two collections from Jiaohe, Jilin were recorded as *S. chiangmaiensis*, Zhuang (1994) noticed that the Chinese fungus differs from the type material from Thailand in hair morphology and in being on wood but did not stress the distinction of spore surface morphology. The recent collection from the Changbai Mountains turns out to be the same fungus as those from Jiaohe. Careful observation reveals that the Chinese fungus has different type of spore markings both under light microscope and in SEM study. The markings are smaller, lower, and less interconnected than those of *S. chiangmaiensis*. Ascospores are slightly narrower and hairs possess more rootlets at base. Spore markings of *S. jilinensis* are higher than those of *S. cubensis* (Schumacher, 1990) but lower than those of *S. fujianensis* (Cao & Moravec, 1988). We describe it as a new species.

Scutellinia patagonica (Rehm) Gamundí, Lilloa 30: 318, 1960.

On mossy rotten wood. HMAS 78028.

Scutellinia scutellata (L.) Lambotte, Fl. Mycol. Belge. Suppl. 1: 299, 1887.

On wood and bark. HMAS 29551, 78029, 78030, 78031, 78032.

Scutellinia subhirtella Svrcek, Ceska. Mykol. 25: 85, 1971.

On wood and bark. HMAS 78024, 78033,78034, 78035, 78036.

Ascospore markings of the above collections are 0.3-1 μm high or 0.3-1.2 μm in diam, isolated, and occasionally coalescent. HMAS 78037 on mossy bark seem to have larger spore markings [0.5-0.7 μm high, 0.8-1(-1.2) μm in diam] and longer hairs (up to 1600 μm long, 45 μm wide). We temporarily treated it as *Scutellinia* cf. *subhirtella*.

Scutellinia cf. ***vitreola*** Kullman, Scripta Mycol. 10: 92, 1982.

On rotten wood chips. HMAS 78039.

Ascospore size of HMAS 78039 fits the description of *Scutellinia vitreola* (Schumacher, 1990) but spore markings are small, less than 0.5 μm in diam.

Spathularia flavida Pers.: Fr., Neues Mag. Bot. 1: 116, 1794.
On duff. HMAS 28639, 28980, 75524.

Trichoglossum hirsutum (Pers.: Fr.) Boud., Hist. Class. Discom. Eur. p. 86, 1907.
On duff. HMAS 30815.

Trichophaea gregaria (Rehm) Boud., Hist. Class. Discom. Eur. p. 60, 1907.
On rotten mossy wood. HMAS 78038.

Unguiculariopsis changbaiensis W.Y. Zhuang, Mycol. Res. 104, 2000 (in press).
长白拟爪毛盘菌
Associated with a pyrenomycete on decorticated wood. HMAS 74849.

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长白山盘菌初探

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本文报道了吉林省长白山地区盘菌 46 个分类单元，它们分属于 12 科 13 属，其中长白白毛盘菌 *Albotricha changbaiensis* 和吉林盾盘菌 *Scutellinia jilinensis* 为新种，小白毛盘菌 *Albotricha minuta*、吉氏小毛盘菌 *Cistella geelmuydenii*、槲小毛钉菌 *Dasyscyphella dryina*、钩毛钩刺盘菌 *Hamatocanthoscypha uncipila*、霉霍氏盘菌日本亚种 *Holwaya mucida* subsp. *nipponica*、（参照）土黄膜盘菌 *Hymenoscyphus* cf. *lutescens*、（参照）千曲菜粒毛盘菌 *Lachnum* cf. *salicariae* 以及膜盘菌的两个未定名种 *Hymenoscyphus* sp. #1 和 *Hymenoscyphus* sp. #2 为我国新记录。

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HYPHOMYCETES FROM CANADIAN STREAMS. V. TWO NEW CONIDIAL BASIDIOMYCETES

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Abstract. Two new taxa with affinity to Heterobasidiomycetes are described from streams in Nova Scotia and New Brunswick. Both taxa produce white fast growing colonies. *Anguillomyces acadiensis* forms soft sclerotia in the central part of the colony and has relatively large, scolecoform conidia without septa. *Nodulospora inconstans* fruits synnematously on sterilized tree leaves. Its conidia are retrogressively thallic. They bear variable numbers of primary and secondary branches and usually one more or less well-developed clamp at the base of one periapical branch.

Key words: heterobasidiomycetes, mitosporic fungi, taxonomy, waterborne hyphomycetes

Introduction

For several years we have been surveying streams in the Maritime provinces of Canada in order to characterize their fungal communities, and where possible, to isolate and describe new taxa. Many streams in this region are characterized by relatively soft water, which often correlates with high species diversity (Bärlocher 1987). Collecting trips undertaken to various streams in New Brunswick and Nova Scotia in 1994 yielded over ten undescribed taxa. Four of them have already been published (Marvanová & Bärlocher 1998 a, b); two more are presented here. Both are assumed to represent mitosporic states of Heterobasidiomycetes. They have clamped mycelium and their conidia germinate by expelling the protoplasm into the germ tube(s) and laying down retraction septa. When examining foam samples microscopically, such conidia are readily identified by having clearly defined cell contours but no cell contents.

Material and Methods

Characteristics of streams

Arsenic Brook and the West Branch of River Philip both occur on the Cobequid Hills in Cumberland County (Nova Scotia), which is situated on a precarboniferous basement complex of igneous and metamorphic rocks. Arsenic Brook at the sampling site is 1 m wide, shallow, and flows over a stony bed. Its alternating riffles and pools are bordered by deciduous trees (*Acer saccharum*, *Betula papyrifera*, *Ostrya virginiana*, etc.). When the samples were collected, the water temperature was 5.5°C, the pH 7.5 and conductivity 40 µS. The West Branch of River Philip is a moderately fast flowing stream, 2-3 m wide, up to 40 cm deep, with a stony bed. The water temperature was 7°C, and the pH 7.6.

Grande Anse River is ca 14 km long and originates below the Cape Breton Highlands (Nova Scotia). In its upper reaches it flows through some bogs. It joins the sea on the West Coast in the Pleasant Bay. It is a fast flowing stream 5-6 m wide at the sampling site.

Corney Brook originates from the Cape Breton Highlands, and joins the sea on the West Coast below Cap Rouge. It is a ca 8 km long, fast flowing stream with a sandy bed covered with gravel and rocks. Its water is relatively cold, well-aerated, circumneutral (Anon. 1951).

North Aspy River is ca 26 km long, originates in the Cape Breton Highlands, flows through an area having carboniferous sedimentary rocks including gypsum in bedrock and joins the sea at the East Coast in the Aspy Bay. It is shallow, fast flowing, with gravel bars, with relatively cold, soft, near neutral water (Anon. 1951, MacPhail et al. 1987).

Cheticamp River is located near the South border of Cape Breton National Park. It is ca 32 km long. In its lower reaches it is about 15 m wide, medium fast, and its bed is covered with gravel. It flows through dense stands of broad-leaved forests. The right tributary, where samples also were collected, is about 2 m wide, with fast flow and stony bed. The side ditch on the right bank of the Cheticamp River is almost stagnant, and has a muddy bed covered with leaves.

Boss Brook is 1.5 m wide stream near Fenwick (nova Scotia), with steep banks at the sampling site (Bärlocher 1987). It is a moderately fast flowing stream with a stony bed shadowed by riparian trees. At the time of sampling, the water temperature was 9˘C, the pH 7.3, and conductivity 50 µS.

Catamaran Brook is a right tributary of the Little Southwest Miramichi River (New Brunswick). It is ca. 20 km long, with circumneutral pH , low alkalinity, conductance and nutrient levels; water temperature in November is below 5°C (Garnett *et al.* 2000). The riparian vegetation consists mainly of deciduous trees, with less abundant conifers.

Isolation of pure cultures

Foam samples were collected into polyethylene bottles and transported to the laboratory in a cooling box with ice cubes. A loopful (sterile loop, 1 cm diam) of liquefied foam was smeared over thin layers of Malt Agar (MA: 0.2% malt extract, 1.5% agar; supplemented with 100 mg/litre of both penicillin and streptomycin) on glass slides. These were incubated in glass Petri dishes at 10° C, and scanned repeatedly during 1-3 days. Germinating conidia were cut out with a flamed thin needle and, together with a piece of the surrounding agar, transferred onto 2 % MA with the same penicillin and streptomycin mixture as above. Six germinating conidia were placed in one Petri dish (9 cm diam) divided into six sectors. For fructification, cultures were inoculated on sterilized (gamma-irradiation) autumn-shed leaves of *Acer pseudoplatanus,* which were incubated for several weeks on plain agar medium at 15ˇC in diffuse light. To study conidiogenesis, pieces of pure colonies were cut out and submerged in standing sterile distilled water incubated at 15 or 18 ˇC. Conidiogenous structures were mounted in lactofuchsin, observed under phase contrast and drawn with the aid of a drawing tube on a light microscope (Olympus BX 40). Germination of conidia from pure cultures was observed on thin layers of 2% MA incubated at 15ˇC for 1-3 days.

Taxonomy and Discussion

Anguillomyces Marvanová et Bärl., gen. nov.

Etym.: *anguilla* (Lat.) = eel, *mykes* (Gr.) = fungus

Fungi mitosporici, Moniliaceae, basidiomycetibus affines.

Mycelium et structurae conidiogenae fibulatae. Hyphae hyalinae. Conidiophora semimacronematosa, singularia, simplicia vel ramificata. Cellulae conidiogenae singulariae vel aggregatae, incorporatae vel discretae, basi fibulatae, fibulae saepe seriatae. Conidia singularia, scolecoformia, curvata, aseptata. Dehiscentia schizolytica.

Typus generis: *Anguillomyces acadiensis*

Mitosporic fungi, moniliaceous, with affinity to basidiomycetes.

Mycelium as well as conidiogenous structures with clamps, hyaline. Conidiophores semimacronematous, single, simple or branched. Conidiogenous cells single or in groups, discrete or integrated, with clamped base, often with a series of clamp remnants at the apex. Conidia single, delimited by a clamp, scolecoform, curved, aseptate. Secession schizolytic, at the basal clamp.

Anguillomyces acadiensis Marvanová et Bärl., anam. sp. nov. (Figs. 1-3; 7 A,B)

Etym.: *acadiensis*: pertaining to French immigrants into Acadia, a former French colony in SE Canada.

Coloniae albae, mediocriter crescentes, funiculosae, cum sclerotiis hemisphaericis albis nonnullis centraliter dispositis, pars reversa luteoalba. Hyphae hyalinae, 1.5-3 (-5) µm latae, plerumque fibulatae. Conidiophora terminalia, hyphis valde similia, simplicia vel parce ramosa, 3-7 µm lata, basi fibulata. Cellulae conidiogenae icorporatae vel discretae, terminales, laterales vel intercalares, singulariae vel aggregatae, nonnumquam seriatae ad apicem conidiophori, cylindricae cum apice truncato, basi fibulatae, 4-62 x 1.5-3 µm, saepe cum serie fibularum subapicali. Conidia singularia vel bina, sequentia, primum conidium incorporatum, cetera discreta, e fibulis ecrescentia, scolecoformia, aseptata, ad apicem basimque versus attenuata, 76-228 x 3.5-6.5 µm, apice subulata, basi truncata vel raro minute bulbosa. Secessio schizolytica.

Holotypus: **DAOM** 226928 (ex CCM F-30694)

Colonies white, growing moderately fast, reaching 30 mm diam/60 d/15°C, minutely fasciculate, margin uneven; several hard, hemispherical, up to 2 mm diam. sclerotial bodies appear in the centre. They are white, later becoming brownish at the surface; reverse white with yellowish hue, later brownish under inoculum, aged colonies producing brown pigment into agar. Advancing hyphae straight, excurrent. Hyphae hyaline, 1.5-3 (-5) µm wide, with clamped primary septa. Haustorial branches absent. Sporulation underwater, after 2 days of submergence in standing water. Conidiophores terminal, integrated, simple or rarely sparsely branched, 3-7 µm wide, with clamps. Conidiogenous cells integrated or discrete, apical or lateral, single or in groups up to 5, sometimes seriate at the apex of a broad conidiophore, cylindrical with truncate apex, sometimes devoid of protoplasm, clamped at the base, 4-62 x 1.5-3 µm, mostly bearing a subapical series of clamp remnants, arising so that the loop of the basal clamp of each conidium remains attached to the conidiogenous cell, and in its turn gives rise to a new conidium.The clamp remnants contain protoplasm. Conidia single or up to two per conidiogenous cell apex, closely sequential, the first integrated with the conidiogenous cell, subsequent conidia discrete, each growing from the basal clamp of the previous conidium, scolecoform, aseptate, tapering towards both ends, 76-228 x 3.5-6.5 µm, apex subulate, base truncate, or bulbous or exceptionally with a short extension or clamp remnant. Secession schizolytic. Germination on agar usually bipolar, clamps not appearing at the site of initiation of germ tubes, protoplasm sometimes emptying into germ tubes, several retraction septa may appear in conidia (Fig. 2 C).

In most conidia germinating *in vitro* no protoplasm migration took place. In aged culture (submerged for 5 weeks in standing water), several one-septate, fatter conidia were observed, some of them breaking into two at the septum (Fig. 2 D). Rarely, few-septate, fat conidia with a single clamp in the middle were seen (Fig. 3 C,D). In foam samples empty conidia with retraction septa and short germ tubes were frequent.

Cultures examined: CCM F-30694, CCM F-30794, CCM F-31294, Canada, Nova Scotia, Cobequid Hills, north of Williamstown, Arsenic Brook (left tributary of the River Philip), isolated from foam collected on 17 Oct. 1994 by L. Marvanová

Collection of conidia in foam: Sample 10/27/94, Canada, Nova Scotia, Cobequid Hills, West Branch of the River Philip, near the cross with the road, foam, 22 Oct. 1994, leg. L. Marvanová.

The first formed conidium has not been seen, but from the shape of the conidiogenous cell as well as the truncate broad detachment scar it is possible to conclude that integrated initiation is involved. Delimitation is with a clamped septum, so that the conidial base is recognizable at an early stage of conidial development. Maturation involves elongation of the conidium. The conidium is then released due to the splitting of the basal delimitation septum and of the septum delimiting the clamp loop from the conidium. Proliferation of conidiogenous cells takes place from the clamp loops (which retain protoplasm during conidiation), i.e. the second and subsequent conidium initials are discrete, growing from the basal clamps of the previous conidia (Fig. 1 A, arrow) The site of conidial secession is variable: in most cases it is very close to the site where the primordium emerged from the clamp. When this process is repeated, it results in a staircase-like series of superposed clamp loops. Sometimes the site of delimitation may be farther above the base of the conidium. The row of clamp loops is then interrupted by a longer segment (Fig. 1 B, arrow). We have not specifically investigated the nuclear behaviour during conidiogeny, but if we accept the clamp loop as being devoid of nuclei (as it normally is), and the new conidium as detached, the only nuclei a new conidial primordium can receive are those from the original conidiogenous cell.

Interpretation of this type of conidiophore proliferation according to the considerations of Minter *et al.* (Minter *et al.* 1982; 1983 a, b) is difficult. Kirschner & Oberwinkler

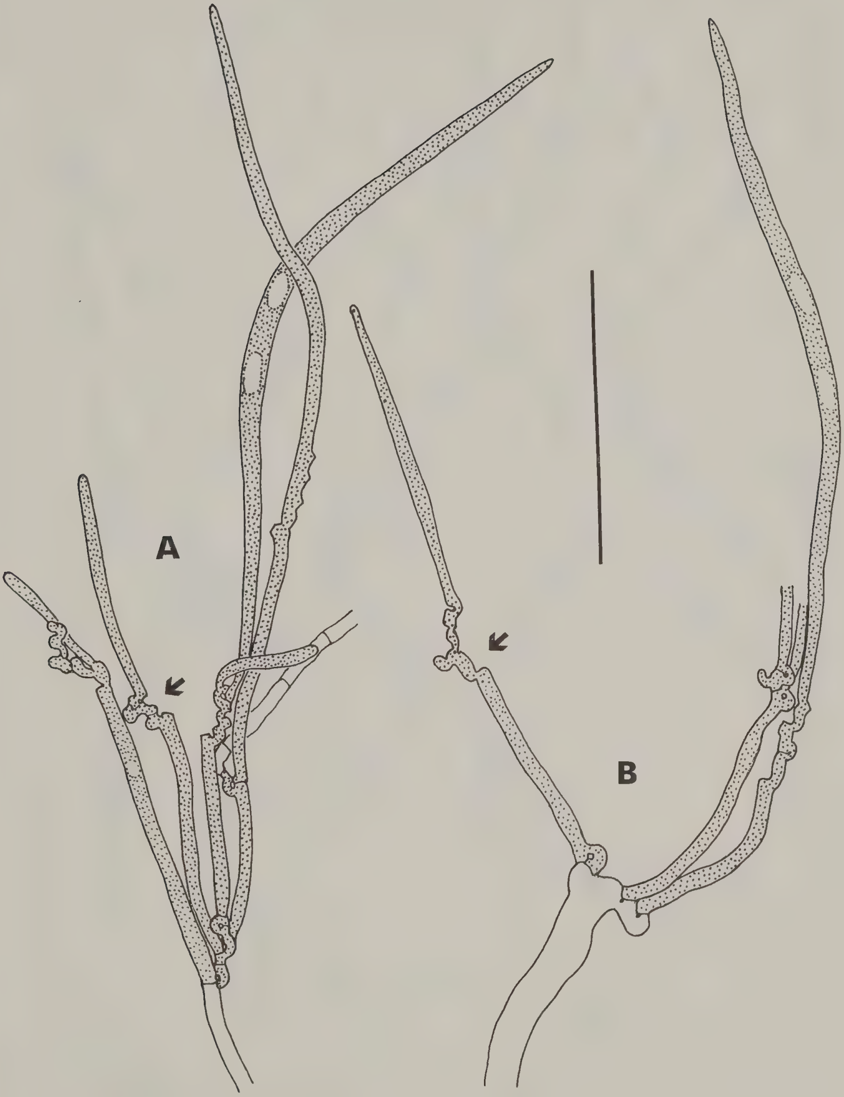

Fig. 1. *Anguillomyces acadiensis* CCM F-30694.. A,B. Conidial development. Note the sprouting clamps at the apices of some conidiogenous cells (arrow). Scale bar = 50 µm.

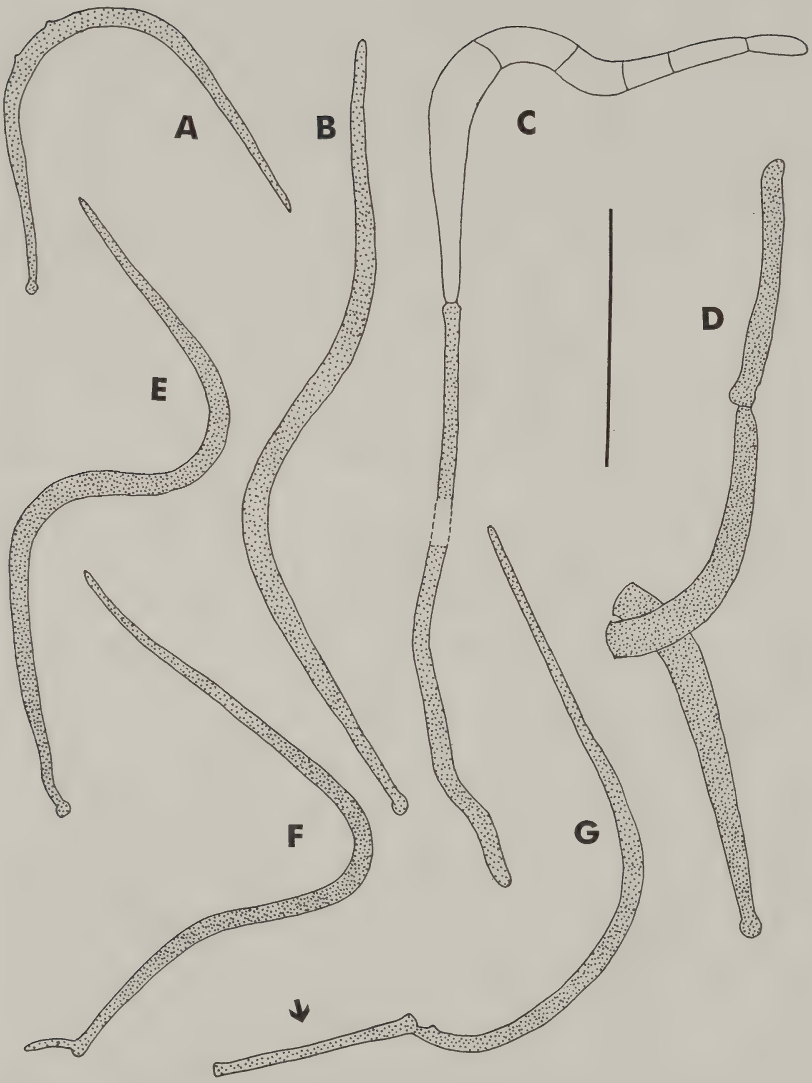

Fig. 2. *Anguillomyces acadiensis* CCM F-30694. A,B,E, F. Detached conidia. C. Germinating conidium with retraction septa. D. Conidium split into halves, germinating without retraction septa. E. Caducous conidiogenous cell (arrow) detached together with a conidium. Scale bar = 50 µm.

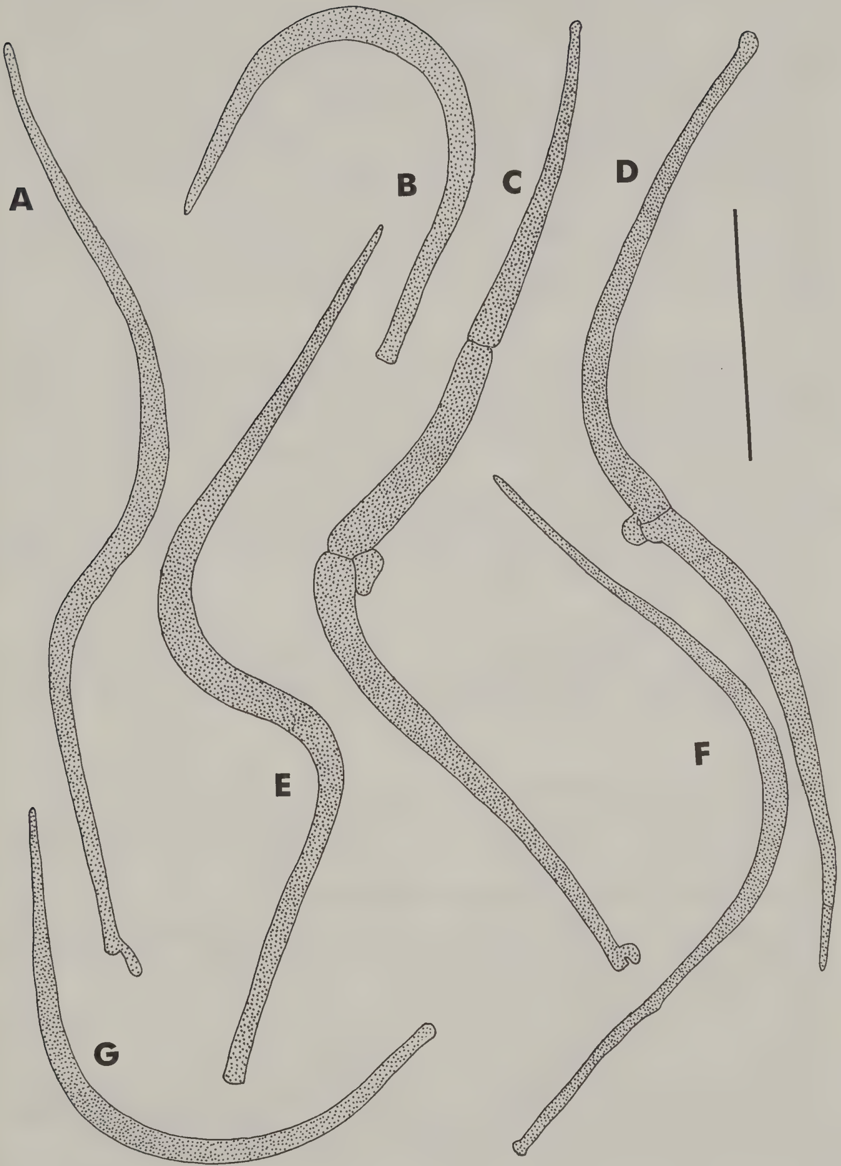

Fig. 3. *Anguillomyces acadiensis* CCM F-30794. A-G. Detached conidia. Note conidia with median clamps (C,D). Scale bar = 50 µm.

(1999), who described such proliferation in their new taxon *Cruciger lignatilis,* called it „percurrent". However, this term, as currently accepted by mycologists, implies the proliferation of a new element (such as conidial primordium or new conidiogenous cell) through the detachment scar of the previous element (Hawksworth *et al.* 1995). The first-formed detachment scar (i.e. the half septum) in *Cruciger* as well as in *Anguillomyces* and other similar fungi is not involved in the formation of the second and subsequent conidia. The clamp loop proliferation cannot be called percurrent, because the second conidial primordium does not grow through any scar or hilum. Nor is it in our opinion sympodial, which by definition means „development of a succession of apices, each of which originates below and to one side of the previous apex" (Hawksworth *et al.* 1995). Clamp loops are in fact backwardly orientated branches of hyphal segments (which in special cases can be conidia) and can hardly be considered apices.

The only hyphomycete with affinity to basidiomycetes, with unbranched aseptate conidia described from water is *Fibulotaeniella canadensis* Marvanová & Bärl., whose conidia are less than half as long and half as wide. No retraction septa and protoplasm migration have been seen in germinating conidia of *F. canadensis* (Marvanová & Bärlocher 1988). *Anguillospora crassa* Ingold, *A. furtiva* Webster & Descals, *A. longissima* (Sacc. & Thérry) Ingold and *A. rosea* Webster & Descals have conidia with dimensions at least partly overlapping those of *Anguillomyces acadiensis.* However, these fungi have ascomycetous teleomorphs (Webster 1992), their conidia are septate, and do not show protoplasm migration. *Anguillospora rosea* conidia have blunt ends (Descals *et al.* 1999).

A. acadiensis was isolated from Arsenic Brook and the West Branch of the River Philip. Since the conidia were isolated from foam, we do no know the natural substrate or habitat of this species. But the relatively large size, thin walls and absence of septa suggest adaptations to moist or wet conditions.

Nodulospora Marvanová et Bärl., anam. gen. nov.

Etym.: *nodulus* (Lat.) = little node; refers to the small inflations appearing on various parts of the conidia.

Fungi mitosporici, Moniliaceae, basidiomycetibus affines.

Hyphae fibulatae. Conidiophora mono- vel synnematosa. Cellulae conidiogenae in conidiophoris incorporatae. Conidia holothallica, singularia vel seriata, ramificata, ramus unus saepe inflatus vel fibulatus apud basim. Extensio parabasalis typice adest.

Typus generis: *Nodulospora inconstans*

Mitosporic fungi, moniliaceous, with affinity to basidiomycetes.

Conidiophores mono- or synnematous. Conidiogenous cells integrated. Conidia holothallic, acrogenous, single or seriate, branched, one branch usually with inflated base, sometimes with a clamp at the insertion. Parabasal extension typically present.

Nodulospora inconstans Marvanová et Bärl., anam. sp. nov. (Figs. 4-6, 7 C-G)

Etym.: *inconstans* (Lat.) = unsettled; refers to the varying pattern of conidial branching.

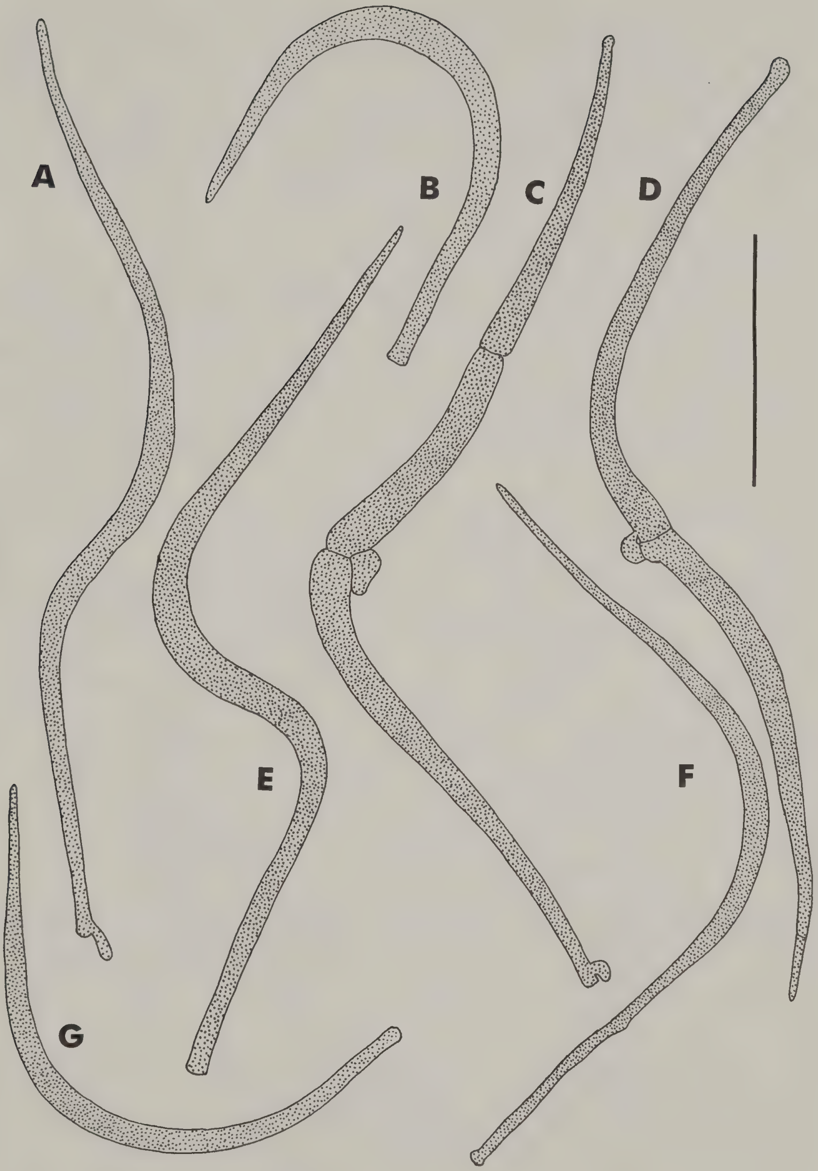

Fig. 4. *Nodulospora inconstans*. Conidial development. A. Profusely branched apical part of a conidiophore with conidia developing from conidiogenous hyphae (CCM F-43694). B,C. Details of conidial series (CCM F-27094). Scale bar = 50 µm.

Coloniae in agaro maltoso albae, lucidae, celeriter crescentes, fasciculatae. Pars reversa sine colore, in parte centrali brunnescens. Hyphae hyalinae, septatae, fibulatae, rami basi fibulati. Conidiophora mononematosa, fasciculata vel synnematosa, synnemata e stipe et capite isodiametrico vel elongato composita. Hyphae conidiogenae terminales vel laterales, nonnumquam ramosae, fibulatae. Conidia in seriebus basipetalibus (retrogressis) vel fortuitis, raro singularia, dehiscentia schizolytica. Conidia ramosa, amplitudine tota 55-125 µm, axis rectus vel plus minusve curvatus, cylindicus vel irregulariter inflatus („nodosus"), apice truncatus vel cum ramo apicali incorporato, basi truncatus, extensio basalis excentrica, raro percurrens. Rami primarii secundariique, saepe 2-3 periapicales, 0-4 laterales, toti insertionibus latis; unus ramus periapicalis saepe basi fibulatus vel cum fibula imperfecta praeditus. Rami secundarii e ramo quolibet exeundi. Extremitates conidiorum saepe sine protoplasma.

Holotypus: **DAOM** 226886 (ex CCM F-27094)

Colonies (MA 2%) white, glistening, growth fast, reaching 20-26 mm diam./15 days/ 15°C, coarsely fasciculate, fascicles radiating, several erect flame-shaped fascicles often present in the centre, margin uneven. Reverse colourless, centre beige to brown. In some isolates, four to six-edged crystals appear in agar. Hyphae hyaline, septate, with clamps, advancing hyphae excurrent, straight, first branches c. 275-550 µm below apex, relatively short, with clamped base and usually a clamp at the opposite side of the parent hypha. Haustorial branches absent. Soft white sclerotia were observed in agar. In two isolates (CCM F-21294 and CCM F-30094) we observed nodose hyphae with slightly thicker walls and bulbous outgrowths (Fig. 6) of unknown function, resembling conidia known in some species of *Tremella* e.g. *T. mesenterica* Retz. : Fr. or *T. aurantialba* Bandoni & M. Zang (Wong et al. 1985, Bandoni & Zang 1990). However, in our material we have not seen them detached. Conidiophores mononematous or loosely fasciculate on submerged pieces of agar culture, or synnematous on gamma irradiated *Acer* leaves on plain agar, where they form a stipe bearing a more or less isodiametrical or elongate conidial head. Stipe medium, determinate, of intricate type (terminology after Seifert 1985), up to ca. 250 µm wide. Conidiogenous hyphae terminal or lateral, sometimes branched, septa often with clamps. Conidia typically in basipetal (retrogressive) or randomly developing series which often are zig-zag, rarely single; secession schizolytic by splitting of the basal septum and of the septum of the clamp loop. Conidia are branched, axis straight, rarely more or less curved, cylindrical, or irregularly inflated, apex truncate or with more or less integrated apical branch, base truncate, basal extension excentric, rarely percurrent, branches primary and secondary, usually 2-3 periapical ones, 0-4 lateral; mostly with broad insertions, one of the periapical ones usually with a swelling near its base, which resembles an incomplete clamp and in fact is the rest of the basal clamp of the subsequent conidium; or with a complete clamp. Conidial span is 55 - 125 µm. Conidial branch ends, usually devoid of protoplasm, are typically delimited by a secondary septum. Germination from conidial ends, protoplasm migration taking place, retraction septa formed.

Cultures examined: CCM F-21294, Canada, Nova Scotia,Cape Breton National Park, Corney Brook; on the cross with the Trans Canada Highway, close to the coast, isolated from foam collected on 8 Oct. 1994 by L. Marvanová; CCM F-29294 (= **DAOM** 226877), CCM F-30094; CCM F-30194, CCM F-30294; CCM F-30394, CCM F-30594, Canada, Nova Scotia, Cape Breton National Park, a side ditch on the right bank of the Cheticamp River, ca 7 km upstream from the junction with River Robert; isolated from foam collected on 9 Oct. 1994 by. L. Marvanová; CCM F-23194; CCM F-23294; CCM F-23494, Canada, Nova Scotia, Cape Breton National Park, right tributary of the Cheticamp River; ca 1 km further upstream from the previous locality, isolated from foam collected on 9 Oct. 1994 by L. Marvanová; CCM F-27094, Canada, Nova Scotia, Cape Breton National Park, Grande Anse River, ca 1 km upstream from Pleasant Bay community, on the cross with Trans Canada Highway; isolated from foam collected on 8 Oct. 1994 by L. Marvanová; CCM F-43694 (= **DAOM** 226879), CCM F-43794, Canada, Nova Scotia,

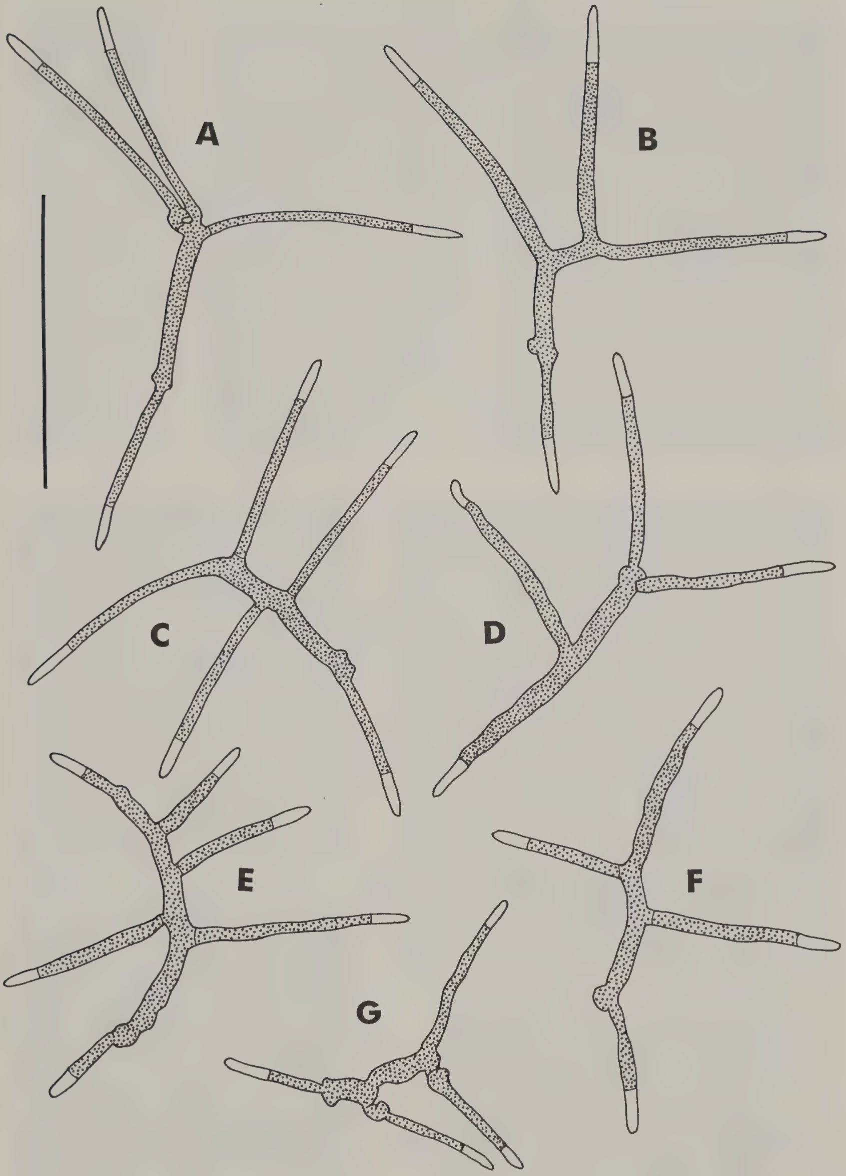

Fig. 5. *Nodulospora inconstans*. Detached conidia. (A-C, E, F, from CCM F-30094; D, G, from CCM F-30594). Scale bar = 50 µm.

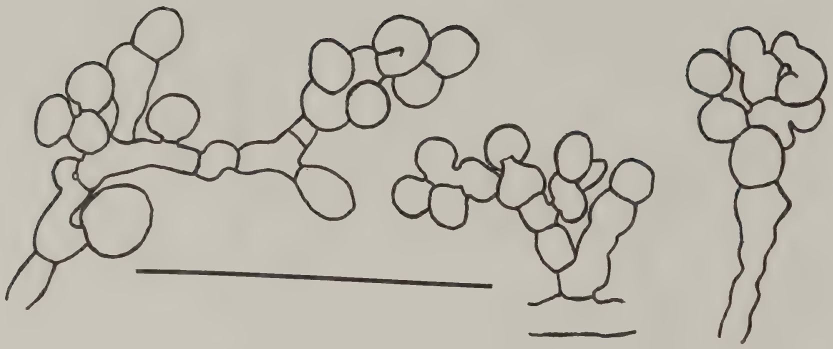

Fig. 6. *Nodulospora inconstans* CCM F-21294. Inflated cells on mycelium with thickened walls. Scale bar = 50 µm.

Boss Brook at the cross with the road, isolated from foam collected on 30 Oct. 1994 by L. Marvanová; CCM F-25394, CCM F-30894; Canada, Nova Scotia, Cobequid Hills, Arsenic Brook, isolated from foam collected on 17 Oct. 1994 by L. Marvanová.

Collection of conidia in foam : Sample No. 10/4/94 Canada, Nova Scotia, Cape Breton National Park, North Aspy River, at the cross with the Trans Canada Highway ca 3 km SW from the community Big Intervale , collected on 8 Oct. 1994 by L. Marvanová. Sample No 11/2/94, Canada, New Brunswick, Miramichi Region, Catamaran Brook, near its confluence with the Little Southwest Miramichi River, at the site called „Lower Riffle 1", collected on 4 Nov. 1994 by L. Marvanová and H. Garnett.

The conidiogenesis of *N. inconstans* is difficult to interpret. Conidiogenous hyphae are not recognizable before the conidia start to produce branches; at this point, the hyphae disarticulate readily. In addition, the conidiogenous structures are usually tightly grouped, which makes it difficult to differentiate between the individual structures. The clamp loops usually remain attached to the conidiogenous hypha when the first conidium is formed; in subsequent conidia, they are attached to the conidium apex. Close observations of conidiogenous hyphae suggest a basipetal or random sequence of conidial delimitation and maturation. According to the definition adopted at the Kananaskis Conference in 1971 (Kendrick 1971), thallic development implies that most developmental processes within the conidium are completed before the delimitation septum is laid down. However, this definition is restricted to relatively simple conidia. Branched conidia with thallic development, like those of *Actinosporella megalospora* (Ingold) Descals & Marvanová undergo considerable changes (development of branches) after the delimiting septum is laid down (Descals 1985).

Some conidia of *N. inconstans* resemble those of *Crucella subtilis* Marvanová & Suberkr. which also germinate with protoplasm migration and where the conidial

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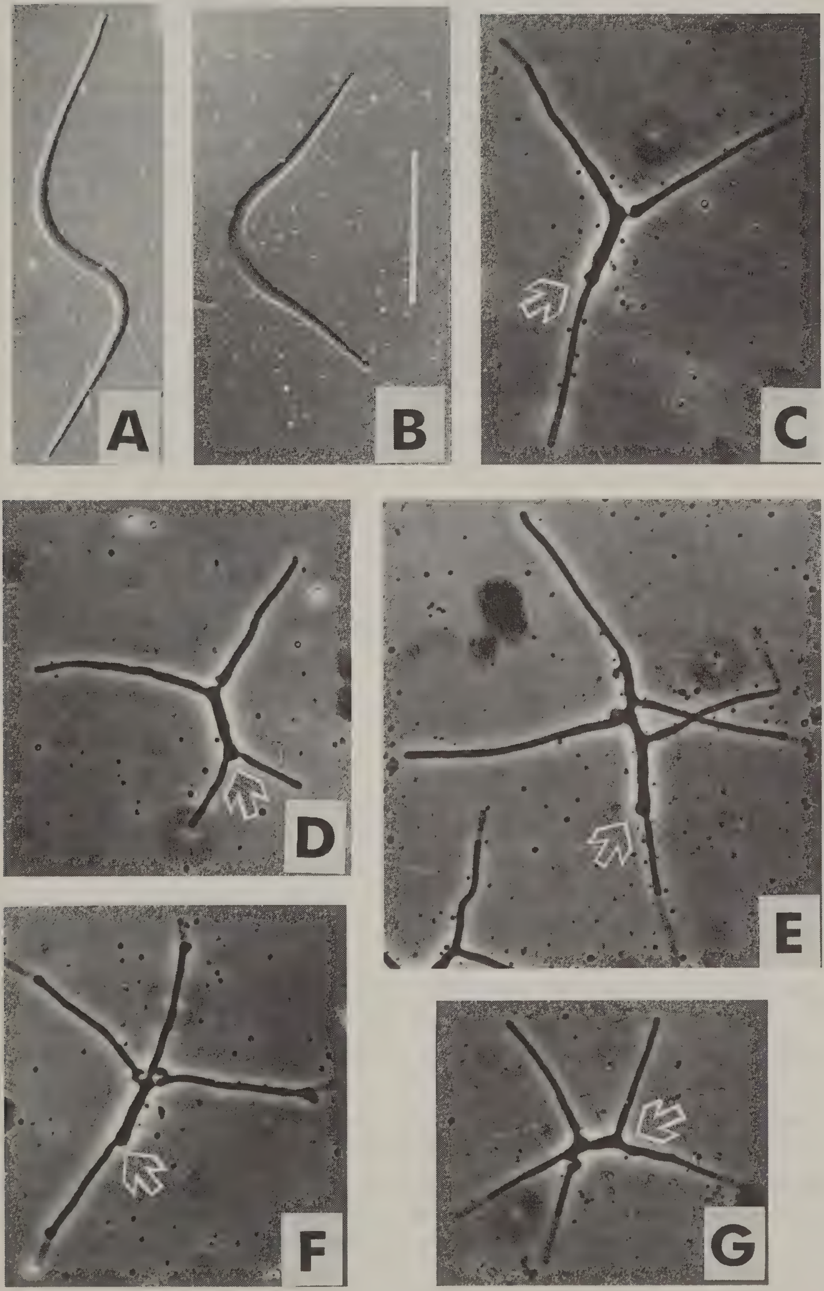
Fig. 7. A,B. *Anguillomyces acadiensis* CCM F-30794, detached conidia. C-G. *Nodulospora inconstans,* conidia with various branching types. Arrows point to the basal detachment scars. Note the complete (in F) or incomplete (in G) clamps at the base of some distal branches. Scale bar in B represents 50 µm and is valid for A-G.


A
B
C
D
E
F
G

branching pattern also varies to some extent. However, colony appearance and conidiogenesis are very different (Marvanová & Suberkropp 1990), and *C. subtilis* conidia never bear clamps or clamp-like swellings.

N. inconstans was isolated from streams in two remote parts of Nova Scotia: Cape Breton National Park and the Cobequid Hills. Its natural substrate and typical habitat are again unknown, since they were isolated from foam. But the *in vitro* formation of synnematous conidiomata on non-submerged leaves and the shape of its conidia suggest that it may be a litter fungus adapted to hydrochory.

Acknowledgements

This contribution was supported by the Natural Science and Engineering Research Council (F. Bärlocher) and by GACR No.206-98-0561 (L. Marvanová). The first author expesses sincere thanks to Prof. Hinrich Harries, Mrs Joan Blakney, Mr. Gerard Aucoin and Miss Heather Garnett for arranging the collection trips to the localities. Dr. E. Descals is thanked for providing photographic facilities. The presubmission review was kindly done by Prof. J. Webster, who is gratefully acknowledged for corrections.

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RHIZOPOGON AROMATICUS (BOLETALES, BASIDIOMYCOTA) A NEW SPECIES FOUND IN SPAIN

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Abstract

Rhizopogon aromaticus is described as a new species, based upon macromorphology, micromorphology and DNA sequencing features. Relationships with close species, such as *R. odoratus* and *R. fragrans,* which also show an aromatic odour, and with *R. ellenae* and *R. fuscorubens* are discused.

Key words: *Rhizopogon aromaticus, Boletales, Basidiomycota,* taxonomy, Spain.

INTRODUCTION

The genus *Rhizopogon* Fr. & Nordholm has recently been monographed for Europe by MARTÍN (1996), with a compilation of 21 species. On the other hand, HAWKSWORTH *et al.* (1995) considered that this genus has 150 species worldwide.

The phylogenetic relationships between *Rhizopogon* and other groups of fungi have been discussed in previous papers (MALENÇON, 1931; MARTÍN, 1996; JOHANNESSON & MARTÍN, 1999), using both morphological and molecular characters. As a result of these investigations *Rhizopogon* is placed within the *Boletales*, as sequestrate forms, which have adapted to the hypogeous life in the course of evolution (PEGLER & YOUNG, 1981; BRUNS *et al.*, 1989).

As a consequence of our research within the project of Flora Mycologica Iberica, we have found several collections which do not fit within any of the descriptions of the known taxa. Thus, we believe that the material studied here is an undescribed species.

MATERIAL AND METHODS

Materials.- The material studied was collected growing under *Pinus pinea, Quercus faginea* and *Cistus monspeliensis*, subhypogeous, angiocarpous, in sandy soil, liberating a very attractive musky smell. Two collections were obtained: Spain, Ciudad Real, Viso del Marqués, Valle de los Perales, 7-XII-1997, leg. F. D. Calonge, MA-Fungi 40582; the same locality, 30-XII-1997, leg. F. D. Calonge & J. Parrilla, MA-Fungi 40583.

Morphological characters.-Specimens were examined to define the macroscopic and microscopic characters, following the criteria of SMITH & ZELLER (1966) and MARTIN (1996).

Molecular analysis.-Total DNA was isolated with EZNA Fungi miniprep kit (Omega Biotek) according to MARTÍN *&* GARCÍA-FIGUERES (1999). Primer pairs ITS1F/ITS4 were used to obtain amplifications of both ITS regions, including the 5.8S of the ribosomal RNA gene cluster. Primers were described in WHITE *et al.* (1990) and GARDES & BRUNS (1993). Amplifications were done using PCR Beads from Pharmacia-Biotech (WINKA *et al.* 1998). Results of amplifications were assayed from 5µl aliquots by gel electrophoresis of 1% ME-Agarose (Seakem, FMC Bioproducts). Amplification products were cleaned using the QIAquick PCR purification kit (QUIAGEN Inc., Chatsworth, CA, USA) and both strands were sequenced separately using the primers ITS1 and ITS4 with an ABI Prism 310 Genetic Analizer and the ABI Prism™ Terminetor Cycle Sequencing Ready Reaction Kit with AmpliTaq®DNA Polymerase (Perkin Elmer Applied Biosystem).

Sequence Navigator™ Sequence Comparison software (Perkin Elmer) was used to identify the consensus sequences from the two strands. The new sequence has been logged in the EMBL database with the Accesion Numbers AF232719 and AF 232720. Sequences obtained in this study were compared with homologous sequences in the alignments mentioned in JOHANNESSON & MARTIN (1999). SEQAPP software for multiple sequences was used to search for the best alignment. Parsimony analysis was performed using the computer program PAUP 4.0b* (SWOFFORD, 1996). Branch robustness was estimated by boostrap analysis (FELSENTEIN, 1985) of 1000 heuristic replicates. The *Rhizopogon aromaticus* sequence was compared by Dr.Lisa Grubisha's with the homologous sequences of her database of *Rhizopogon* from United States.

RESULTS

DESCRIPTION

Rhizopogon aromaticus Calonge & M.P. Martín, sp. nov. (fig. 1)
Etym.*: aromaticus,* referring to its attractive musky odour when mature.

Diagnosis.- *Basidiomata aggregata, subhypogaeus, angiocarpous, globosa, subglobosa, tuberoidea vel irregularia, 2.5 cm lata, sessilis. Peridium rufobrunneum dein nigrum. Gleba cremea brunnea, loculis minutis composita. Columella nulla. Sporae ellipsoidae vel naviculate, biguttulatae, 6-7.2 x 2-3 µm, leve amiloideae.Basidia tetrasporica, cylindrica, 20-25 x 14-16 µm. Brachybasidiola pyriformae, aequalis dimensionis basidia. Peridium simplum, circa 165 µm latum, roseolus-typus. Trama hymenophoralis homomera, hypha 3.5-4 µm lata, gelatinosa refractiva. Subhymenium circa 30 µm latum, pseudoparenchymaticum.*
Hispania, Ciudad Real, Viso del Marqués, Valle de los Perales, *subter Pinus pinea, Quercus faginea et Cistus monspeliensis, 7- XII-1997, legit F. D. Calonge. Holotypus: MA-Fungi 40582.*

Basidiomata aggregate, glabrous, subhypogeal, angiocarpous, globose, subglobose, tuberoid to irregular, 2-5 cm diam., sessile (fig. 1a), showing a strong and attractive musky odour when ripe. Peridium glabrous, reddish brown, finally almost black. Gleba cream-colour then brown, made of small locules. Columella, sterile base and rhizomorphs lacking. Spores elliptic to naviculate, non truncate, 6-7.2 x 2-3 µm, pale yellowish smooth and biguttulate. In Melzer´s reagent small areas of the spore wall become dark bluish (fig. 1b). Basidia 4-spored, cylindrical, 20-25 x 14-16 µm. Brachybasidioles in general are vesiculose (fig. 1c). Peridium simple, up to 165 µm thickness. Outer part up to 80 µm thickness, presenting hyphae running parallel to the surface, *roseolus*- type. These hyphae are 4.5-5 µm diam., yellowish, thin-walled,

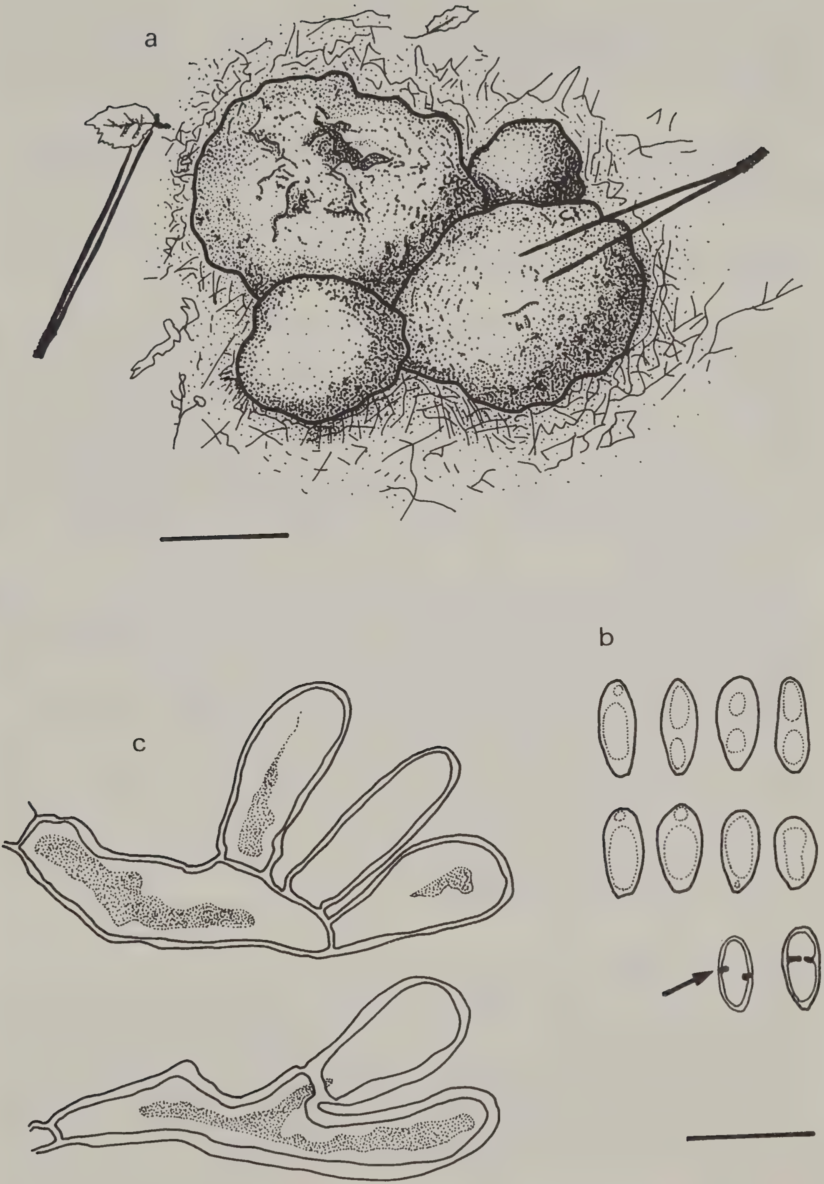

Fig. 1 *Rhizopogon aromaticus.* a) Basidiomata, b) Braquibasidioles, c) Spores (→ Melzer's reaction).

septate, unbranched, with amorphous pigment. The inner part is made of hyaline interwoven , 4-5 µm diam hyphae. Hymenophoral trama up to 40 µm thickness, made of laxly interwoven hyphae, 3.5- 4 µm diam., rather gelatinized, refractive, septate, thin-walled and little branched. Subhymenium up to 30 µm thickness, pseudoparenchymatous showing a gelatinous-refractive aspect. In the cladistic analysis, *R. aromaticus* clades as a sister group of *R. luteolus* and *R corsicus.*

Holotypus: Spain, Ciudad Real, Viso del Marqués, Valle de los Perales, aggregate, under *Pinus pinea, Quercus faginea* and *Cistus monspeliensis,* 7-XII-1997, leg. F. D. Calonge. MA-Fungi 40582.

DISCUSSION

The most typical feature of our material is the production of a very strong musky odour, when ripening. At this moment the gleba becomes chocolate brown with syrupy consistency. The taste is also fruity, similar to mature fruits, such as grapes, apples, prunes, pineaples, etc.

There are two North American species with similar odour: *R. odoratus* A. H. Sm. and *R. fragrans* A. H. Sm. (SMITH & ZELLER, 1966). The first one can be distinguished by its fibrillose peridium, truncate spores and, 6-spored basidia. On the other hand, *R. fragrans* has a duplex peridium which is subtomentose when fresh, basidia often collapsed, and not reviving. We do not have data for the sequences of either taxa. The first amplifications obtained from *R. odoratus* holotype and *R. fragrans* paratype correspond to contaminations; however, new attempts are in progress.

Rhizopogon ellenae A. H. Sm. and *R. fuscorubens* A. H. Sm. are another two interesting species, first described in the United States (SMITH & ZELLER, 1966) and recently found in Spain (MARTÍN, 1996) as the only extra-American specimen. Both species show the same weak amyloid reaction in the spores, like *R. aromaticus*, but they are separated by the following features: The peridium of *R. ellenae* is *roseolus*-type, too, but the basidioma forms rhizomorphs, the brachybasidioles are vesiculate, in general, and the basidia are 4- 8-spored.

Finally, *R. fuscorubens* also shows abundant rhizomorphs, which are black, but the peridium is *luteolus*-type. Moreover, the basidia are 2-4-6-spored, without well- developed sterigmata, collapsing at maturity. Both, *R. ellenae* and *R. fuscorubens* lack any fragrant odour. According to Dr. Grubischa (personal communication), the sequence of *R. aromaticus* does not fit with any of the species in her database

Thus, we conclude that the combination of characters compiled for *Rhizopogon aromaticus* is enough to consider it as a new species.

ACKNOWLEGMENTS

We would like to express our sincere gratitude to Isabel Bernardino and José Parrilla and the rest of members of the Asociación Viseña de Amigos de la Naturaleza (AVAN) for their enormous kindness and hospitality during our visits to Viso del Marqués. To Dr. Grubisha (Oregon University) for her kind help in comparing the sequence of *R. aromaticus* in her database. To the Director of the MICH herbarium for the loan of the type collections. To Dr. Marian Glenn (Seton Hall University) for her kind English revision. Financial support has been received from the DGES and CSIC, under the research project no. 95-0129-003-01.

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TYPE STUDIES ON AGARICS DESCRIBED BY N. PATOUILLARD (AND HIS CO-AUTHORS) FROM VIETNAM[1]

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Abstract Thirty-six types of agarics described by N. Patouillard, either alone or with other mycologists, from Vietnam were critically restudied. Eight new combinations are made. They are ***Mycena bambusa*** (Pat. & Dem.) Z. L. Yang; ***Melanoleuca demangei*** (Pat.) Z. L. Yang; ***Conocybe fracticeps*** (Pat. & Dem.) Z. L. Yang; ***Leucocoprinus bonianus*** (Pat.) Z. L. Yang; ***Stropharia albosulfurea*** (Pat.) Z. L. Yang; ***Marasmiellus patouillardi*** (Sacc. & Syd.) Z. L. Yang; ***Oudemansiella neuroderma*** (Pat.) Z. L. Yang; ***Psilocybe griseobadia*** (Pat.) Z. L. Yang. *Hiatula tonkinensis* Pat., *Lepiota tonkinensis* Pat., and *Leucocoprinus dolichaulus* var. *cryptocyclus* Pat. are synonyms of *Termitomyces microcarpus* (Berk. & Br.) Heim, *Leucoagaricus rubrotinctus* (Peck) Singer, and *Macrolepiota dolichaula* (Berk. & Br.) Pegler & Rayner respectively. *Lentinus mollipes* Pat. and *Pleurotus radicosus* Pat. are conspecific with *Lentinus giganteus* Berk. *Androsaceus sessilis* Pat. and *Lepiota anceps* Pat. are probably synonyms of *Marasmius tenuissimus* (Jungh.) Singer and *Micropsalliota erythrospila* (Berk. & Br.) Pegler respectively. A new name, ***Agaricus iocephalusiopsis*** Z. L. Yang, is proposed for *Agaricus iocephalus* Pat. Important characters observed from the types are illustrated in eighty-three line drawings.

Key words Types, Agaricales, N. Patouillard, Vietnam, Southeast Asia

During study of Agaric specimens made from tropical Yunnan, southwestern China, I found that it is quite necessary to study types of Agarics described by N. Patouillard (and his co-authors) from Vietnam. In 1999 I had an opportunity to visit Boston. Thanks to Pfister (1977, 1980), it was easy for me to find and study some specimens of Patouillard's herbarium housed in Farlow Herbarium (FH), Harvard University, Cambridge, Massachusetts, USA. Thirty-six types of Agarics collected from Vietnam were critically reexamined. The results are reported herein.

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[1] The project supported by the National Natural Science Foundation of China (Grant No. 39800007 & 39899400), and by the National Science Foundation of the USA (Grant DEB-97-05795).

In the following account, the species are arranged alphabetically according to the original generic name, and then specific epithet. Names of accepted species are in bold face. If the type specimen was found to represent a collection of a previously described species, this is indicated by "=" followed by a citation of the accepted name in bold face. Numbers cited in the Patouillard herbarium represent sheet numbers. Several different specimens might be arranged on the same sheet.

Macroscopic descriptions are based on dried specimens unless otherwise noted. I have consulted the original colored illustrations, which were prepared by and/or for V. Demange, and are preserved at the Farlow Reference Library (simply cited as "Demange's colored illustrations" in the following text). The paintings are very natural, and available in microform (Pfister, 1985).

For microscopic studies, free-hand sections of dried basidiocarps were prepared. As mounting medium, 5% KOH was used. Spores were examined in Melzer's reagent or in 5% KOH. The following abbreviation: [*n/m/p*] shall mean *n* spores from *m* basidiocarps of *p* collections. Dimensions for spores are given using notation of the form *(a-)b-c(-d)*. The range *b-c* contains a minimum of 90% of the measured values. Extreme values, e.g., *a* or *d* are given in parentheses. Q is used to mean 'length/width ratio' of a spore in side view; **Q** means average Q of all specimens ± sample standard deviation. Where necessary (e.g. in the descriptions of *Coprinus leucostictus*), Q_1, Q_2, $\mathbf{Q_1}$ and $\mathbf{Q_2}$ are used. Q_1 is used to mean 'length/width ratio' of a spore in side view; $\mathbf{Q_1}$ means average Q_1 of all specimens ± sample standard deviation. Q_2 is used to mean 'length/width ratio' of a spore in ventral view; $\mathbf{Q_2}$ means average Q_2 of all specimens ± sample standard deviation.

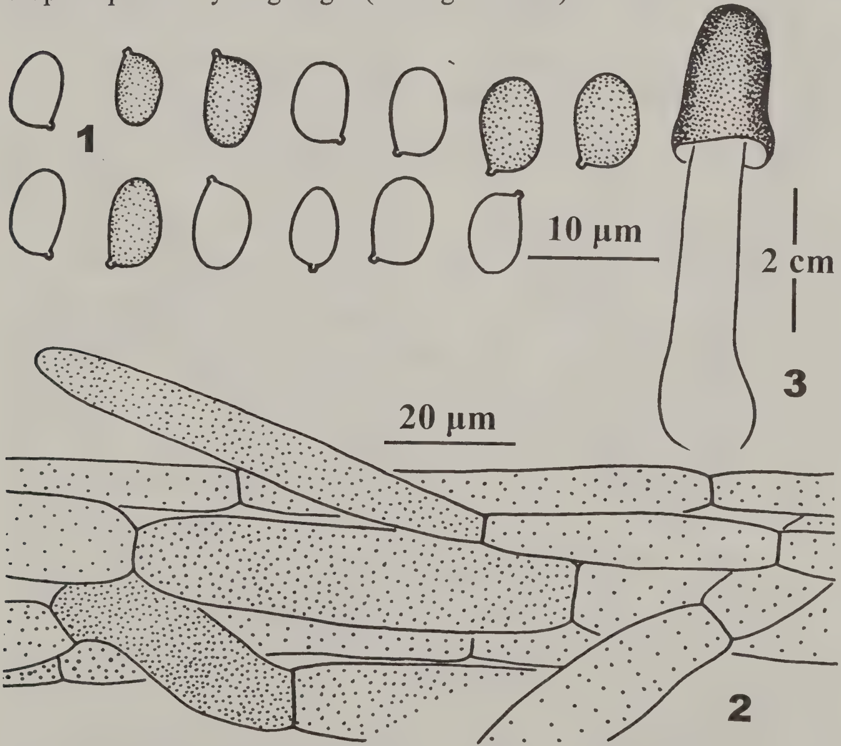
1. *Agaricus iocephalus* Pat., Bull. Soc. Mycol. France **29:** 217 (1913), *non Agaricus* (*Mycena*) *iocephalus* Berk. & Curt., Ann. Mag. Nat. Hist. II, **12:** 420 (1853) [≡ *Collybia iocephala* (Berk. & Curt.) Singer, Lloydia **9:** 116 (1946)].

Pileus 5-13 cm in diam, convex to applanate, grey-brown to brownish, with darker, repent, fibrillose squamules. Lamellae free to nearly free, pinkish brown. Stipe 6-10 × 0.5-1 cm, subcylindric, white; base enlarged, yellowish; annulus present; context white but yellow at base.

Spores [36/2/1] 5.5-7.0 × (3.5-)4.0-4.5(-5.0) µm [Q = (1.33-)1.40-1.63(-1.75), **Q** = 1.51 ± 0.08], ellipsoid, sometimes slightly attenuate toward the apex, brown, slightly thick-walled, without germ pore (Fig.1). Cheilocystidia not recovered. Pileipellis consisting of repent, long ellipsoid to subcylindric elements (25-80 × 4-18 μm) with yellowish brown, vacuolar pigment (Fig. 2). Clamps not seen.

Specimen Examined: Hanoi, Vietnam, M. Demange 349 (Herb. Patouillard, FH 4380-lectotype, designated here).

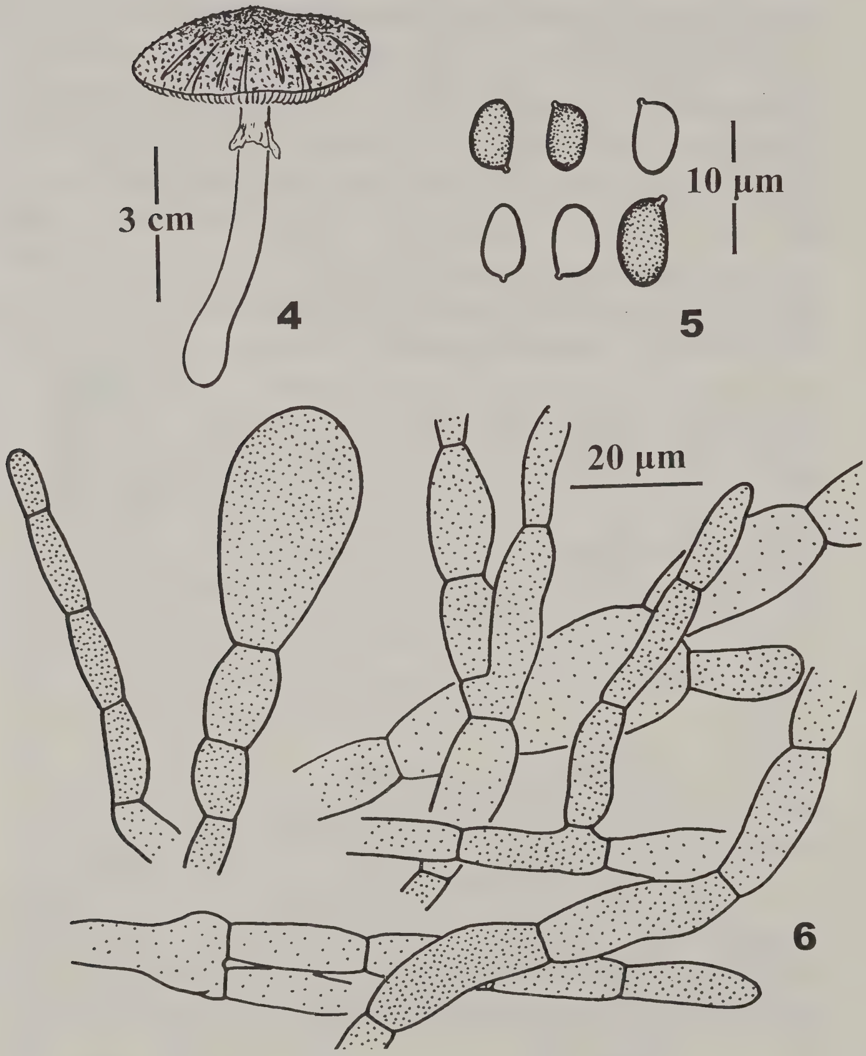
Note: In the above description the color and size of the basidiocarps are mainly based on Demange's colored illustrations of the lectotype. In the protologue (Patouillard, 1913: 217), two collections Demange 86 & 349 were cited under *Agaricus iocephalus*. In Farlow Herbarium I only found Demange 349, and in the Farlow Reference Library the original colored illustrations of Demange 86 & 349. Demange 349, consisting of two fruitbodies, is designed here as lectotype. Patouillard's name *Agaricus iocephalus* is a homonym, and so ***Agaricus iocephalusiopsis*** Z. L. Yang, **nom. nov.** (≡ *Agaricus iocephalus* Pat., Bull. Soc. Mycol. France **29:** 217, 1913) is proposed. Because this species is still poorly known, its relationship with other taxa is unclear. Patouillard (1913) emphasized the shape of pileus at young stages (see Fig. 3 below).



Figs. 1-3: *Agaricus iocephalus* Pat. 1. Basidiospores (lectotype); 2. Pileipellis (lectotype); 3. Basidiocarp at young developing stage (Demange 86).

2. ***Agaricus phaeocyclus*** Pat., Bull. Soc. Mycol. France **29:** 217 (1913).

Pileus ca 5-8 cm in diam, convex to applanate, dark olivaceous-brown, radially fissile to expose a white context; margin often appendi-



Figs. 4-6: *Agaricus phaeocyclus* (holotype). 4. Basidiocarp; 5. Basidiospores; 6. Squamules on pileus.

culate; context white. Lamellae free to nearly free, pinkish brown. Stipe 4-8 × 0.5-0.8 cm, subcylindric, greyish fibrillose to finely squamulose; base sometimes enlarged, fistulous; annulus white, pendant from ca 1 cm below apex of stipe, upper surface whitish, lower surface with greyish squamules; context yellowish (Fig.4).

Spores [36/3/1] (4.5-)5.0-6.5(-7.5) × 3.0-4.0(-4.5) μm [Q = (1.10-) 1.50-1.83(-1.88), **Q** = 1.62 ± 0.14], ellipsoid to elongate, sometimes slightly attenuate towards the apex, brown, slightly thick-walled, without germ pore (Fig. 5). Cheilocystidia not recovered. Squamules on pileus consisting of subvertically arranged to repent, ovoid to ellipsoid to subcylindric elements (15-70 × 5-28 μm) with brownish, brown or dark brown, vacuolar pigment (Fig. 6). Clamp connections not seen.

Specimen Examined: La Pho, Tonkin, Vietnam, M. Demange 388 (Herb. Patouillard, FH 4382-holotype).

Note: In the above description the color and size of the basidiocarps are mainly based on Demange's colored illustrations. This taxon is very similar to *Agaricus actinorachis* Berk & Br. if they are not conspecific. *Agaricus hypophaeus* Heinem. and *A. endoxanthus* Berk. & Br. are also similar to *A. phaeocyclus* (see Heinemann, 1980: 31; Pegler, 1986: 339).

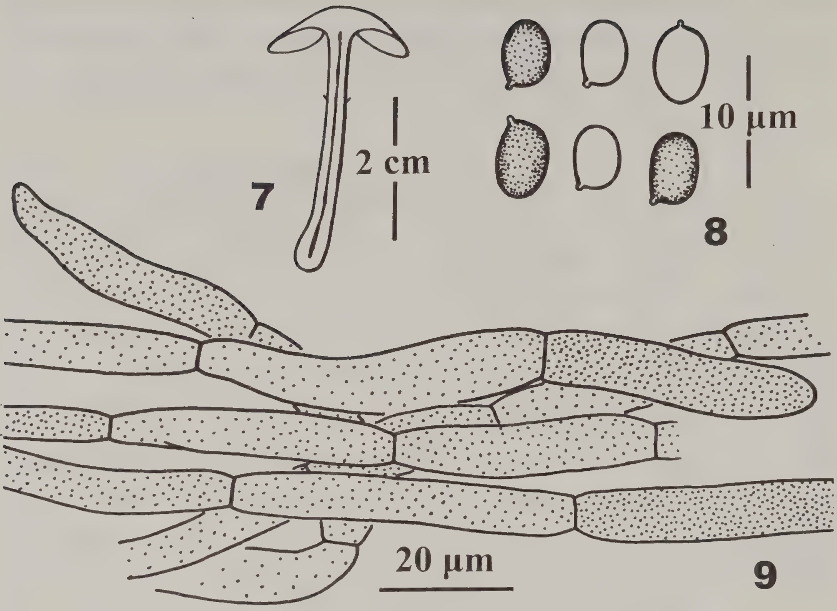
3. ***Agaricus rhopalopodius*** Pat., Bull. Soc. Mycol. France **29:** 218 (1913).

Pileus ca 2.5 cm in diam, convex, purplish red over disc, paler to white toward margin, with red to purplish red fibrillose squamules; context white. Lamellae free to nearly free, brown. Stipe ca 3.5 × 0.3 cm, subcylindric to attenuate upwards, white, becoming yellowing at enlarged base; annulus white, ca 1 cm below apex of stipe; context white (Fig. 7).

Spores [20/1/1] 4.5-6.0 × (3.0-)3.5-4.0 μm [Q = 1.29-1.57, **Q** = 1.42 ± 0.10], ellipsoid, brown, slightly thick-walled, without germ pore (Fig.8). Cheilocystidia not recovered. Squamules on pileus consisting of ± reflexed to repent, cylindric elements (40-100 ×5-10 μm) with purplish brown pigment (Fig. 9). Clamp connections not seen.

Specimen Examined: Hanoi, Vietnam, M. Demange 400 (Herb. Patouillard, FH 4384-holotype).

Note: In the above description the color and size of the basidiocarp are mainly based on Demange's colored illustrations. This taxon is similar to *Agaricus purpurellus* (F. H. Møller) F. H. Møller but the latter has somewhat smaller spores (see Pegler, 1977: 333; Heinemann, 1980: 20; Kühner & Romagnesi, 1984: 416).



Figs. 7-9: *Agaricus rhopalopodius* (holotype). 7. Basidiocarp; 8. Basidiospores; 9. Squamules on pileus.

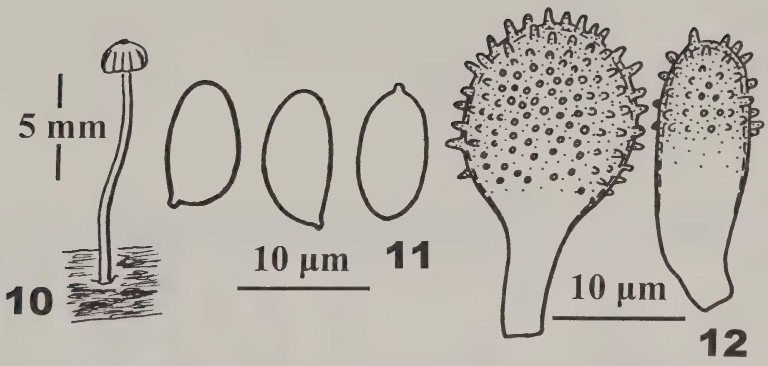
4. *Androsaceus griseobadius* Pat., Bull. Soc. Mycol. France **12:** 133 (1896).

≡ ***Marasmius griseobadius*** (Pat.) Sacc. & Syd., Syll. Fung. **14:** 101 (1899).

Pileus 1-5 mm in diam, grey-fuscous, conical-campanulate, often with a papilla; margin sulcate striate. Lamellae adnate without forming a collar, white, distant. Stipe 5-15 × 0.5-1 mm, glabrous, dark brown, insititious (Fig.10).

Spores [10/1/1] 9.0-10.0(-11.0) × (4.5-)5.0-6.0 µm [Q = 1.64-2.0 (-2.22), **Q** = 1.87 ± 0.16], elongate, colorless hyaline, inamyloid, thin-walled, smooth (Fig. 11). Pleurocystidia 25-35 × 5-8 µm, fusiform, abundant. Cheilocystidia similar to pleurocystidia, but scattered. Pileipellis an epithelium of *Rotalis*-type broom-cells 17-25 × 7-20 µm, clavate, broadly clavate to sphaeropedunculate, with the upper third to the upper two-thirds dark brown and densely verrucose, lower half hyaline and thin-walled (Fig. 12).

Specimen Examined: Ke So, Tonkin, Vietnam, Bon 4845 (Herb. Patouillard, FH 4117-holotype). On rotten branches of plant.



Figs. 10-12: *Androsaceus griseobadius* (holotype). 10. Basidiocarp; 11. Basidiospores; 12. Elements of pileipellis.

Note: The holotype specimen is in poor condition. Cheilocystidia like the broom-cells on the pileus were not recovered. *Marasmius micraster* Petch is very similar to *M. griseobadia* (see Petch, 1947; Pegler, 1986). It is unknown whether there are pleurocystidia in M. *micraster*.

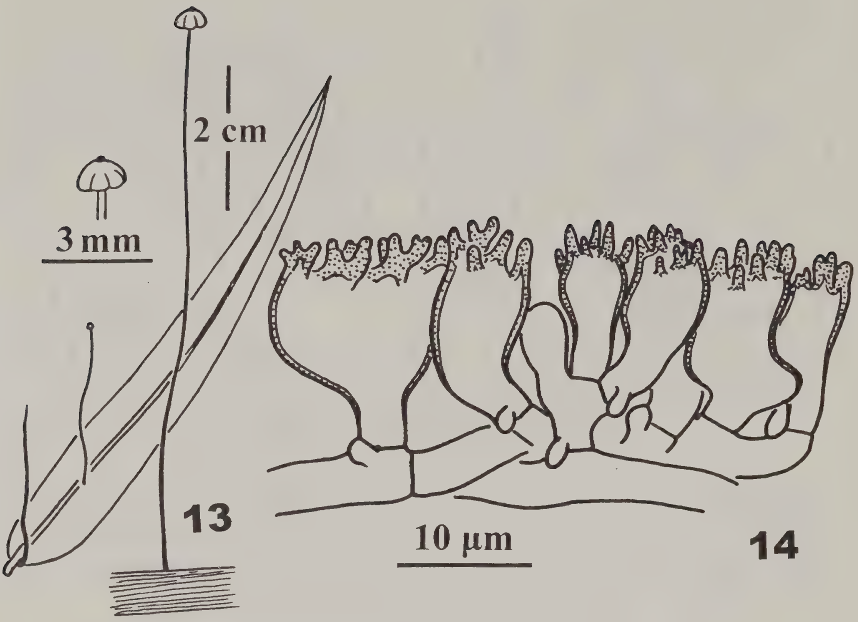
5. *Androsaceus nigrobrunneus* Pat., J. Bot. (Morot) **5:** 308 (1891)
≡ ***Marasmius nigrobrunneus*** (Pat.) Sacc., Syll. Fung. **11:** 37 (1895).

Pileus 1-5 mm in diam, conical-campanulate, often with a papilla, dark brown; margin sulcate striate. Lamellae collariate, white, distant. Stipe 2-7 cm × 0.5-1 mm, black to dark brown (Fig.13).

Spores [4/1/1] 6.5-9.0 × 3.0-3.5 µm [Q = 2.17-2.57, **Q** = 2.29 ± 0.20], elongate to cylindric, colorless hyaline, inamyloid, thin-walled, smooth. Pleurocystidia lacking. Cheilocystidia similar to the broom-cells on pileus, only sometimes paler. Pileipellis a hymeniform layer made up of broadly clavate to clavate broom-cells 10-20 × 5-10 µm, apex with brown to yellow-brown outgrowths 2-4 µm high (Fig. 14). Clamps common.

Specimen Examined: Ke So, Hanoi, Vietnam, Bon 4357 (Herb. Patouillard, FH 4125-holotype). On rotten leaves or debris of bamboo.

Note: The holotype specimen is probably not fully mature, as only a few spores were observed. This taxon is a typical member of *Marasmius*. It is a pantropical species according to Singer (1976: 128) and Pegler (1986: 150). *Marasmius brevicollus* Corner, supposed to be allied with this species, possesses, however, significantly longer spores (see Corner, 1996: 37).

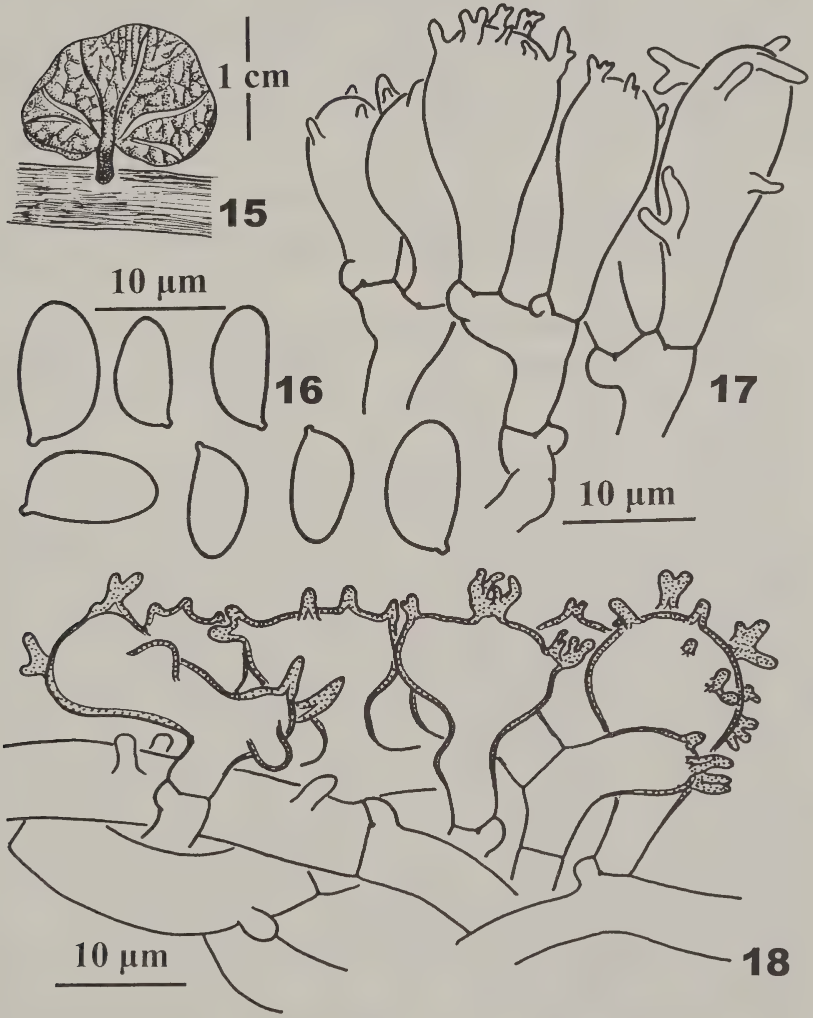


Figs. 13-14: *Androsaceus nigrobrunneus* (holotype).
13. Basidiocarps; 14. Pileipellis.

6. *Androsaceus sessilis* Pat., Bull. Soc. Mycol. France **12:** 132 (1896)
≡ *Marasmius sessilis* (Pat.) Sacc. & Syd., Syll. Fung. **14:** 116 (1899).
? = ***Marasmius tenuissimus*** (Jungh.) Singer, Fl. Neotr. Monogr. **17:** 258 (1976) ≡ *Agaricus tenuissimus* Jungh., Verh. Batav. Genootsch. **17:** 84, 1838).

Pileus 10-20 mm in diam, flabelliform to reniform to suborbicular, ochraceous to reddish brown, rugose, glabrous; margin undulate. Lamellae adnate, radiating from an excentric point, strongly interwoven to subreticulate, whitish, up to 1 mm high, distant, 4-7 in total. Stipe lacking or very short and eccentric, 1-2 mm long, dark (Fig.15).

Spores [25/1/1] (7.5-)8.0-10.5(-11.0) × (4.0-)4.5-6.0(-6.5) µm [Q = (1.54-)1.58-2.10(-2.22), **Q** = 1.85 ± 0.18], elongate to subamygdaliform, colorless hyaline, thin-walled, smooth, inamyloid (Fig. 16). Pleurocystidia lacking. Cheilocystidia crowded, 10-20 × 5-12 µm, clavate to broadly clavate; apex with finger-like to ramaroid outgrowths (2-7 µm long), almost colorless to yellowish, thin-walled, sometimes branching (Fig. 17). Tramal hyphae of lamellae not gelatinized, inamyloid. Pileipellis a hymeniform layer made up of broadly clavate to sphaeropedunculate to irregularly shaped cells 20-40 × 10-20 µm, upper part with finger-like outgrowths (2-5 µm high) with yellow-brown slightly thickened walls (Fig. 18). Hyphae of context of pileus inamyloid, non-dextrinoid. Clamps common.



Figs. 15-18: *Androsaceus sessilis* (holotype). 15. Basidiocarp; 16. Basidiospores; 17. Cheilocystidia; 18. Pileipellis.

Specimen Examined: Ke So, Hanoi, Tonkin, Vietnam, Bon 4853 (Herb. Patouillard, FH 4133-holotype). On rotten woods [bamboo?].

Note: This taxon is apparently a representative of *Marasmius*. In the protologue, the spore size was described as 6-8 × 4-5 µm. My measurements are larger than those given in the descriptions. *Marasmius sessilis* is easily mistaken for a species of *Marasmiellus* or *Campanella* owing to the pleurotoid habitus and the strongly interwoven hymenophore. It is probably a synonym of *M. tenuissimus* (Jungh.) Singer, originally described from Java, and reported from Sri Lanka (Pegler, 1986: 170) and tropical America (Singer, 1976: 258).

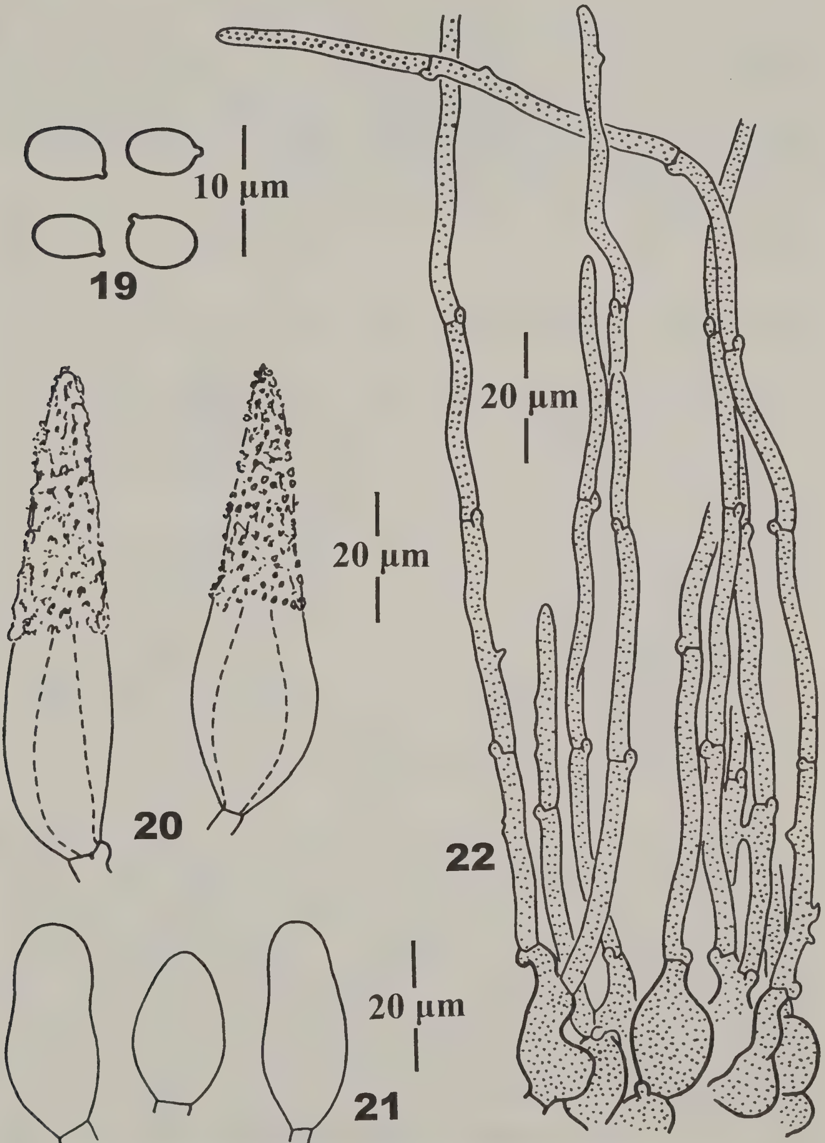
7. *Calathinus aratus* Pat. & Dem., Bull. Soc. Mycol. Fr. **26:** 38 (1910).
≡***Hohenbuehelia arata*** (Pat. & Dem.) Singer, Lilloa **22:** 255 (1951).
≡ *Pleurotus aratus* (Pat. & Dem.) Sacc. & Trott., Syll. Fung. **21:** 68 (1912).

Pileus 5-15 mm wide, flabelliform, densely covered with dark grey to brownish grey, strigose hairs. Lamellae moderately crowded, becoming dark brown to blackish. Stipe practically lacking, only attenuate base of pileus.

Spores [11/1/1] (4.5-)5.0-6.0 × (3.0-)3.5-4.0 µm [Q = (1.29-)1.32-1.67(-1.71), **Q** = 1.45 ± 0.13], ellipsoid, colorless hyaline, thin-walled, smooth (Fig. 19). Basidia 18-20 × 4.5-5.5 µm, clavate, 4-spored; basal septa with clamps. Pleurocystidia 40-80 × 12-18 µm, ventricose-fusiform to sublanceolate, often thick-walled (less than 6 µm thick), with a brownish to yellow-brown wall, upper half often encrusted (Fig. 20). Cheilocystidia 20-32 × 10-18 µm, broadly clavate to ellipsoid, colorless hyaline, thin-walled (Fig. 21). Hairs on pileus made up of aggregating, frequently septated, cylindrical hyphae 120-250 × 2-5 µm, thin to slightly thick-walled (less than 0.5 µm thick), with brownish, vacuolar pigment, with rounded apex (Fig. 22). Pileipellis ca 20 µm thick, made up of subglobose to ellipsoid or irregularly inflate cells 13-40 × 11-15 µm, slightly thick-walled (less than 1 µm thick), with brownish, vacuolar pigment (Fig. 22). Context of pileus below pileipellis consisting of gelatinized, filamentous hyphae 2-5 µm wide. Clamps common.

Specimen Examined: Hanoi, Tonkin, Vietnam, V. Demange 296 (Herb. Patouillard, FH 3773-holotype).

Note: The holotype is probably not fully mature. Only a few basidia with sterigmata, and a few spores were observed. *Hohenbuehelia arata* differs from *H. calceola* by its longer hairs on the pileus, 4 - spored basidia, differently shaped cheilocystidia, and inflated cells in pileipellis. The pileipellis of *H. mellea* is somewhat similar to that of *H. arata* (see Corner, 1994: 21).



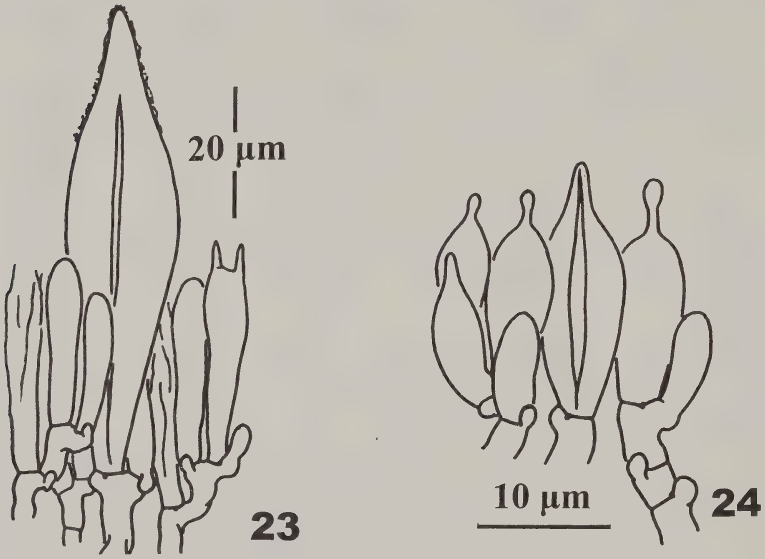
Figs. 19-22: *Calathinus aratus* (holotype). 19. Basidiospores; 20. Pleurocystidia; 21. Cheilocystidia; 22. Hairs on pileus and pileipellis.

8. *Calathinus calceolus* Pat. & Dem., Bull. Soc. Mycol. France **26:** 39 (1910).

≡ ***Hohenbuehelia calceola*** (Pat. & Dem.) Singer, Lilloa **22:** 255 (1951) ["1949"].

≡ *Pleurotus calceolus* (Pat. & Dem.) Sacc. & Trott., Syll. Fung. **21:** 68 (1912).

Pileus 0.5-1 cm wide, flabelliform, grey to greyish brown, covered with whitish hairs, becoming glabrous toward the margin. Lamellae white, subdistant, with lamellulae. Stipe lacking.



Figs. 23-24: *Calathinus calceolus* (holotype).
23. Basidia and pleurocystidium; 24. Cheilocystidia.

Spores [5/1/1] 7.0-8.5 × 4.0-4.5 µm [Q = 1.56-1.89, **Q** = 1.73 ± 0.16], ellipsoid to elongate, colorless hyaline, thin-walled, smooth. Basidia 30-35 × 6.5-7.0 µm, clavate, 2-spored, rarely 3- or 4-spored; sterigmata 4-5 µm long; basal septa with clamps (Fig. 23). Pleurocystidia abundant, 30-90 × (7-)15-28 µm, ventricose-fusiform, often thick-walled (less than 8 µm thick), with yellowish walls, apical part often encrusted with crystals (Fig. 23). Cheilocystidia 10-20 × 4-6 µm, clavate to ventricose, colorless hyaline, thin-walled, apex capitate and sometimes finely encrusted (Fig. 24). Some cheilocystidia similar to pleurocystidia, but smaller in size. Hairs on pileus made up of often septated, cylindrical hyphae 70-150 × 3-7µm µm wide, slightly thick-walled (less than 1 µm thick), colorless hyaline, with rounded apex.

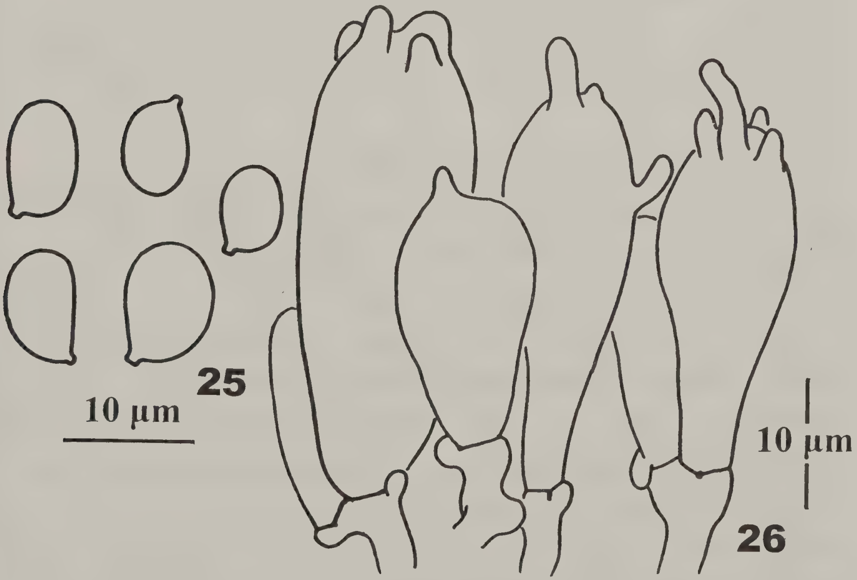
Pileipellis made up of hardly inflated, subcylindrical hyphae, 3-7(-10) µm wide, frequently septated and clamped, often with encrusted pigment. Context of pileus below pileipellis consisting of gelatinized, filamentous hyphae 2-5 µm wide. Clamps common.

Specimen Examined: Hanoi, Tonkin, Vietnam, V. Demange 305 (Herb. Patouillard, FH 3776-holotype). On rotten bamboo.

Note: The holotype is probably not fully mature. Only a few spores were observed, and are not globose as described in the protologue. *Hohenbuehelia malesiana* Corner (1994) is similar to this species, but differs from the latter by its larger fruitbodies, relatively narrower spores and 4-spored basidia.

9. *Cantharellus bambusae* Pat. & Dem., Bull. Soc. Mycol. France **26:** 32 (1910).

Pileus 5-12 mm in diam, convex to applanate, often depressed at center, grey to olivaceous grey. Lamellae somewhat decurrent, white, ca 1mm in height. Stipe 1-2 × 0.1-0.2 cm, subcylindric, white.



Figs. 25-26: *Cantharellus bambusae* (holotype).
25. Basidiospores; 26. Cheilocystidia.

Spores [20/1/1] 6.5-8.5(-9.0) × 4.5-6.0(-6.5) µm [Q = (1.27-)1.30-1.70(-1.76), **Q** = 1.47 ± 0.14], ellipsoid, colorless hyaline, distinctly amyloid, thin-walled (Fig. 25). Basidia 25-32 × 7-10 µm, clavate, 4-spored; sterigmata 3-4(-5) µm long; basal septa with clamps. Pleurocystidia lacking. Cheilocystidia crowded, 17-38 × 8-13 µm, clavate to broadly clavate, sometimes sub-ellipsoid to subfusiform, colorless hyaline, thin-walled, apex often with a few outgrowths (Fig.26). Pileipellis not rehydrating.

Specimen Examined: Hanoi, Vietnam, M. Demange 9 (Herb. Patouillard, FH 4473-holotype). On branches or roots [of bamboo ?].

Note: In the above description the color and size of the basidiocarps are mainly based on Demange's colored illustrations. Other data are from observations on the holotype specimen. Having not studied the holotype, Corner (1966: 245) regarded *Cantharellus bambusae* as a dubious species, and excluded it in his monograph of cantharelloid fungi. The lamellate lamellae, the relative short basidia, and the amyloid spores lead this taxon to *Mycena* rather than *Cantharellus*. Thus, a new combination is proposed here: ***Mycena bambusa*** (Pat. & Dem.) Z. L. Yang, **comb. nov.** [Basionym: *Cantharellus bambusae* Pat. & Dem., Bull. Soc. Mycol. France **26:** 32 (1910)]. *Mycena bambusa* is similar to *M. cinerella* (Karst.) Karst., but differs from the latter by the form of cheilocystidia (Smith, 1971: fig. 45/7; Breitenbach & Kränzlin, 1991: 264-265)

10. *Collybia demangei* Pat., Bull. Soc. Mycol. France **23:** 77 (1907).

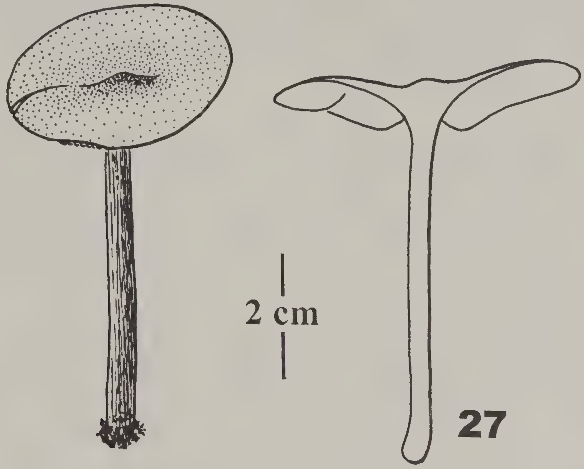
Pileus 3-6 cm in diam, convex, often umbonate, greyish to brownish, darker on center; context greyish. Lamellae sinuate, white. Stipe 3.5-6 × 0.3-0.5 cm, cylindric, greyish, with brownish tinge (Fig. 27).

Spores [20/1/1] 7.5-9.0 × 4.5-6.0 µm [Q = (1.36-)1.38-1.64(-1.73), **Q** = 1.53 ± 0.09], ellipsoid, thin-walled, colorless hyaline, bearing a strongly amyloid, verrucose ornamentation except for a somewhat well defined, smooth suprahilar plage (Fig. 28). Basidia 30-45 × 7-8 µm, 4-spored; sterigmata 3-4 µm long. Pleurocystidia and Cheilocystidia not recovered. Clamps not seen.

Specimen Examined: Hanoi, Tonkin, Vietnam, M. Demange 237 (Herb. Patouillard, FH 4049-holotype).

Note: In the above description the color and size of the basidiocarps are mainly based on Demange's colored illustrations. Although the holotype specimen rehydrates poorly, this taxon apparently belongs to *Melanoleuca* due to its habitus, and amyloid, warty spores. Therefore, a new combination is proposed here: ***Melanoleuca demangei*** (Pat.) Z. L. Yang, **comb. nov.** [Basionym: *Collybia demangei* Pat., Bull. Soc. Mycol.

France **23:** 77 (1907)]. *Collybia orientalis* Pat. is conspecific with this taxon (see below). *Melanoleuca demangei* is probably related to *M. conspurcata* (Berk. & Br.) Pegler, but the latter has short decurrent lamellae (Pegler 1986: 211).



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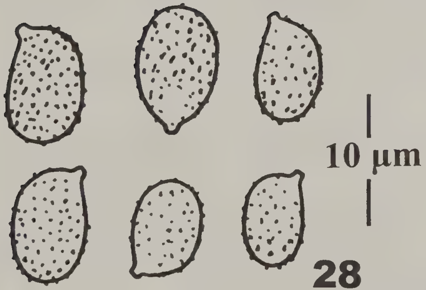

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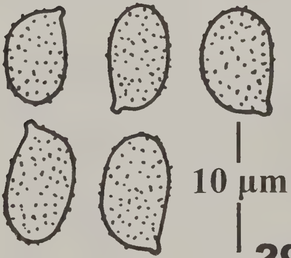

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Figs. 27-28:*Collybia demangei* (holotype). 27. Basidiocarps; 28. Basidiospores.
Fig. 29: Basidiospores of *Collybia orientalis* (holotype).

11. *Collybia orientalis* Pat., Bull. Soc. Mycol. France **33:** 56 (1917).
= ***Melanoleuca demangei*** (Pat.) Z. L. Yang (see above).

Spores [20/1/1] 6.5-8.5(-9.0) × 4.5-6.0 µm [Q = (1.36-)1.40-1.73 (-1.88), **Q** = 1.54 ± 0.13], ellipsoid, thin-walled, colorless hyaline, bearing a strongly amyloid, verrucose ornamentation except for a somewhat well defined, smooth suprahilar plage (Fig. 29). Pleurocystidia and Cheilocystidia not recovered. Clamps not seen.

Specimen Examined: Than Moi, Tonkin, Vietnam, M. Demange 152 (Herb. Patouillard, FH 4059-holotype).

Note: In the protologue, the collection number of the holotype was wrongly cited as Demange 162, and the spores were incorrectly described as smooth, measuring 6 × 4 μm. Although the holotype specimen rehydrates poorly, there are no significant differences between *Collybia orientalis* Pat. and *Melanoleuca demangei* (Pat.) Z. L. Yang (see above) according to Demange's colored illustrations, and the microscopic characters observed.

12. *Coprinus leucostictus* Pat., Bull. Soc. Mycol. France **33:** 61 (1917).

Pileus 1.5-3 cm in diam, campanulate to subconical, greyish ochraceous, with long, plicate striations, covered with subconical to granular, white to whitish veil remnants. Lamellae adnate, crowded, greyish brown, becoming black. Stipe 6-9 × 0.4-0.6 cm, subcylindric, or slightly attenuate upwards, white to dirty white (Fig. 30).

Spores [28/1/1] (10.0-)10.5-13.0(-13.5) × 6.0-7.0(-7.5) × (6.0-)6.5-7.5 μm [Q_1 = 1.47-1.92(-2.0), $\mathbf{Q_1}$ = 1.76 ± 0.14; Q_2 = 1.54-1.85(-1.92), $\mathbf{Q_2}$ = 1.73 ± 0.11], ellipsoid, chocolate brown, thick-walled, with a truncate germ pore (Fig. 31). Veil remnants on pileus made up of frequently branching hyphae 2-10(-15) μm wide, almost hyaline, sometimes brownish yellow, thin- to thick-walled (1-2 μm thick) (Fig. 32). Clamps common.

Specimen Examined: Hanoi, Tonkin, Vietnam, M. Demange 287 (Herb. Patouillard, FH 4457-holotype).

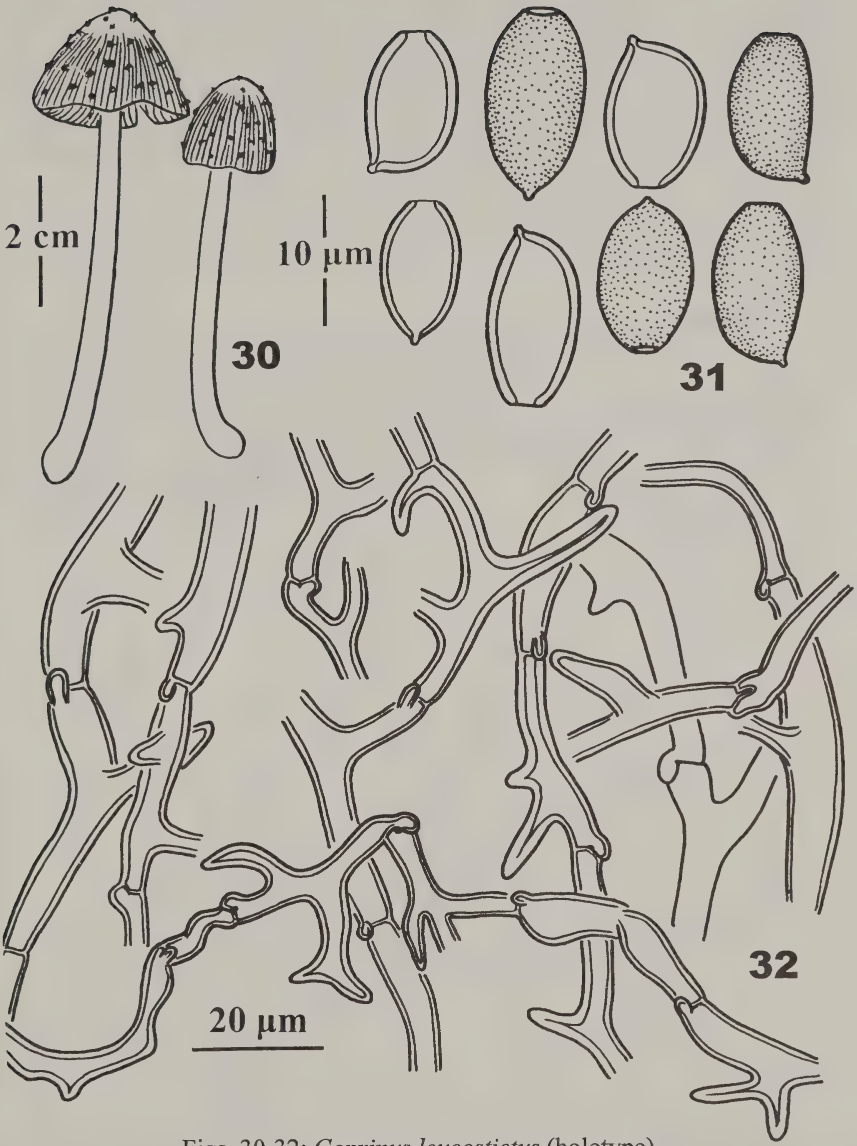
Note: In the above description the color and size of the basidiocarps are mainly based on Demange's colored illustrations. *Coprinus leucostictus* can be placed in the subsect. *Alachuani* Singer of sect. *Coprinus*. *Coprinus friesii* Quél. and *C. pseudofriesii* Pilát & Svrček are similar to this taxon, but differ by their smaller basidiocarps and smaller spores (see Orton & Watling, 1979; Uljé & Noordeloos, 1997).

13. *Crinipellis atrobrunnea* Pat., J. Bot. (Morot) **5:** 308 (1891).

≡ *Marasmius atrobrunnea* (Pat.) Sacc., Syll. Fung. **11:** 38 (1895).

Pileus ca 5-10 mm in diam, convex to applanate, dark brown to blackish, covered with dark brown, strigose hairs, not zoned. Lamellae adnate, dark brown. Stipe 2-3 × 0.1 cm, brown, covered with brown, strigose hairs.

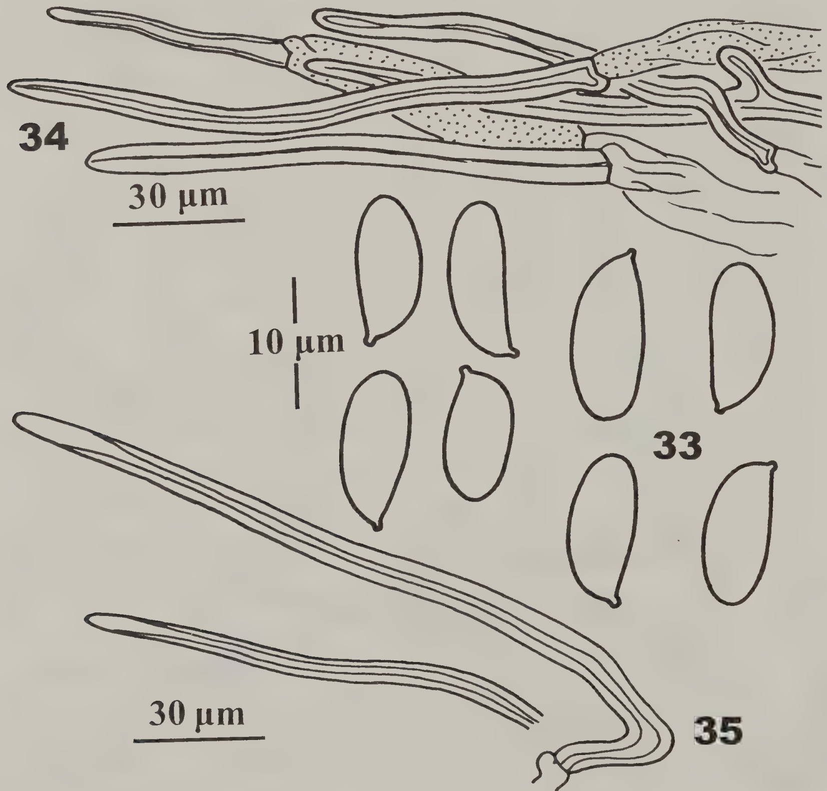
Spores [38/2/1] (9.5-)10.0-12.5(-14.0) × (4.0-)5.0-6.5(-7.0) μm [Q = (1.69-)1.77-2.35(-2.90), **Q** = 2.13 ± 0.22], elongate with a tapering base, thin-walled, hyaline, inamyloid, not dextrinoid (Fig. 33). Basidia 30-35 × 6-8 μm, clavate, 4-spored, often with olive contents (in 5% KOH). Cheilocystidia not recovered. Pileipellis a hypotrichium developing


2 cm
30
10 µm
31
20 µm
32

Figs. 30-32: *Coprinus leucostictus* (holotype).
30. Basidiocarps; 31. Basidiospores; 32. Veil remnants on pileus.

numerous, repent hairs on pileus 50-140 × 3-7 µm, slender, long cylindric, with a tapering but obtuse apex, and dark yellow brown to yellow brown, thickened wall. Hypotrichium of repent chains of subcylindric to long ellipsoid cells 45-75 × 5-15 µm, thin-walled, with olive-yellow contents (Fig. 34). Hairs on stipe similar to those on pileus, 100-230 × 5-8 µm, long cylindric, with brown to olivaceous, thickened walls (up to 2.5 µm thick) (Fig. 35). Clamps common.

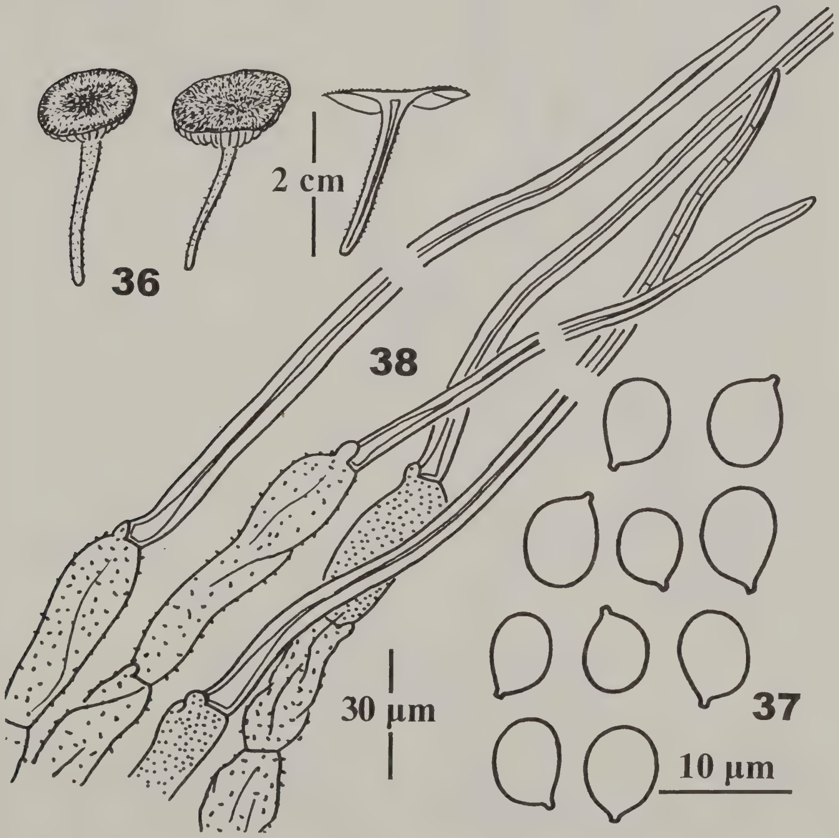
Specimen Examined: Ke So, Tonkin, Vietnam, Bon 4362 (Herb. Patouillard, FH 4076-holotype and isotype). On rotten wood or grass.



Figs. 33-35: *Crinipellis atrobrunnea* (holotype).
33. Basidiospores; 34. Hairs on pileus; 35. Hairs on stipe.

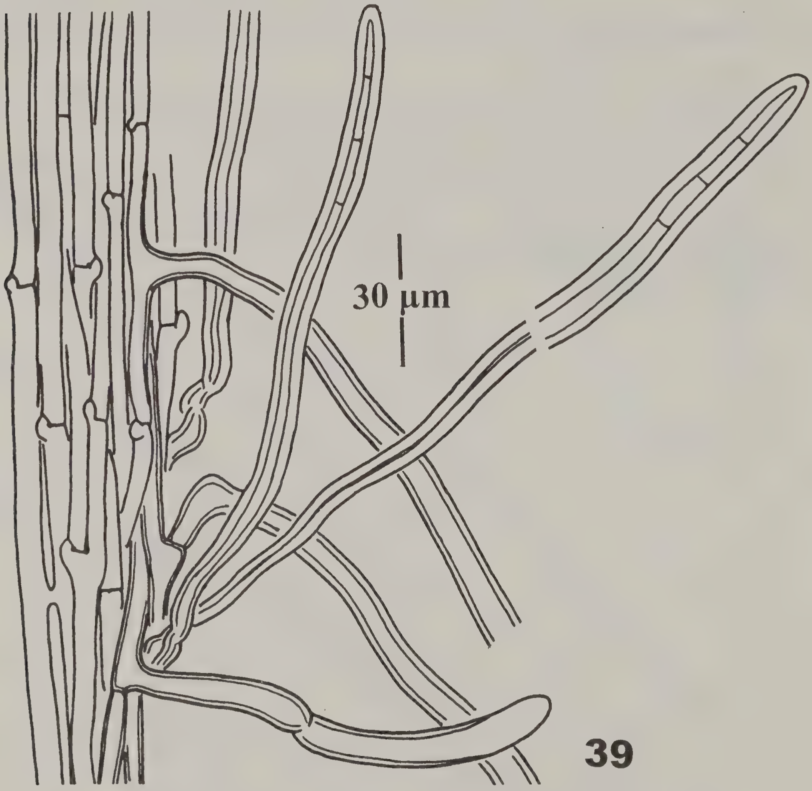
Note: In the protologue, the spore size of *C. atrobrunnea* was described as 9-10 × 5-6 µm. Singer (1943: 482) reported the spores were 8.5-9.5 × 4-4.5(-5) µm. My measurements differ from their reports. This species is similar to *C. omotricha* (Berk.) Reid, reported from Republic of South Africa and Sri Lanka (Pegler, 1986: 139), and *C. hepatica* Corner (1996) from Singapore. *Crinipellis omotricha* has shorter spores and longer hairs on the pileus. *Crinipellis hepatica* has shorter stipe and smaller spores. *Crinipellis atrobrunnea* is also similar to *C. stipitaria* (Fr.) Pat. which, however, possesses smaller spores and longer hairs on the pileus (see Pegler, 1977: 211).

14. *Crinipellis sepiaria* [as "*saepiarius*"] Pat. & Dem., Bull. Soc. Mycol. France **26:** 36 (1910).
≡ *Marasmius sepiarius* [as "*saepiarius*"] (Pat. & Dem.) Sacc & Trott., Syll. Fung. **21:** 112 (1912).



Figs. 36-38: *Crinipellis sepiaria* (holotype). 36. Basidiocarps; 37. Basidiospores; 38. Hairs on pileus and elements of hypotrichium.

Pileus ca 1-2 cm in diam, convex to applanate, sometimes slightly depressed at the disc, greyish to grey, densely covered with dark brown to dark grey, radially arranged, usually azonate, sometimes zonate, long strigose hairs (up to 1.5 mm long along the pileal margin). Lamellae sinuate to adnexed, whitish, sometimes becoming brownish, moderately crowded to subdistant. Stipe 1.5-2 × 0.1-0.2 cm, often attenuate towards base, brownish, covered with purplish brown, strigose hairs (Fig. 36).



39

Fig. 39: *Crinipellis sepiaria* (holotype).
Trama of stipe and hairs on stipe surface.

Spores [30/2/1] 5.5-7.0 (-7.5) × (4.5-)5.0-6.0 µm [Q = 1.08-1.30 (-1.50), **Q** = 1.22 ± 0.10], subglobose to broadly ellipsoid, thin-walled, colorless hyaline, inamyloid, not dextrinoid (Fig. 37). Basidia 25-35 × 7-8 µm, clavate, 4-spored, colorless to nearly colorless. Cheilocystidia not recovered. Pleurocystidia not seen. Pileipellis a hypotrichium developing numerous, repent hairs on pileus 300-900 × 5-7 µm, long cylindric, sometimes septated, with colorless or grey-brown, thickened walls (up to 4 µm thick) (Fig. 38). Hypotrichium of repent chains of oblong to ellipsoid cells 35-70(-130) × 10-20 µm, thin-walled, with grey-brown contents and incrusted pigments. Hairs on stipe 100-400 × 6-12 µm, slender, long cylindric, sometimes septated, with a tapering but obtuse apex, and grey-brown, thickened wall (Fig. 39). Clamps common.

Specimen Examined: Hanoi, Vietnam, M. Demange 290 (Herb. Patouillard, FH 4092-holotype).

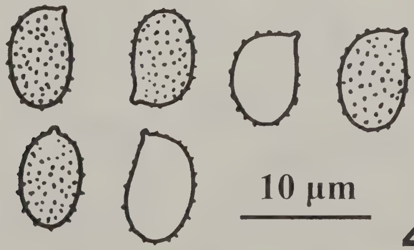
Note: In the above description the color and size of the basidiocarps are mainly based on Demange's colored illustrations. Singer (1943: 481) indicated that the holotype of *C. sepiaria* is Demange 220 (FH). In fact, Demange 220, which I couldn't located in Patouillard's herbarium housed at Farlow, is probably *Naucoria* (*Agrocybe*) *pediades* (see Pfister, 1985: 11). Patouillard & Demange (1910) supposed *C. sepiaria* to be similar to *C. stipitaria* (Fr.) Pat., a widespread North temperate species, but the former has differently shaped spores and shorter hairs on the pileus (see Pegler, 1977: 211).

15. *Flammula hanoiensis* Pat., Bull. Soc. Mycol. France **23:** 77 (1907).

? = ***Gymnopilus dilepis*** (Berk. & Br.) Singer, Lilloa **22:** 560 (1951).

Pileus 4-6 cm in diam, convex to applanate, chocolate brown or grey-brown with pinkish tinge, covered with brownish squamules. Lamellae sinuate to adnate-decurrent, ochraceous brown, crowded. Stipe 6-8 × 0.5-0.8 cm, subcylindric, grey to woody colored.

Spores [26/1/1] (6.0-)6.5-8.5(-9.0) × 4.0-5.0(-5.5) µm [Q = (1.33-) 1.40-1.67 (-1.78), **Q** = 1.58 ± 0.11], ellipsoid, rarely elongate, often with a suprahilar depression, yellowish-brown, lacking a germ pore, with a verrucose ornamentation (Fig. 40). Basidia 20-25 × 6.5-7.5 µm, clavate, 4-spored, often with ochraceous contents. Cheilocystidia not recovered. Pileipellis of repent, filamentous hyphae 2-8(-12) µm wide.



40

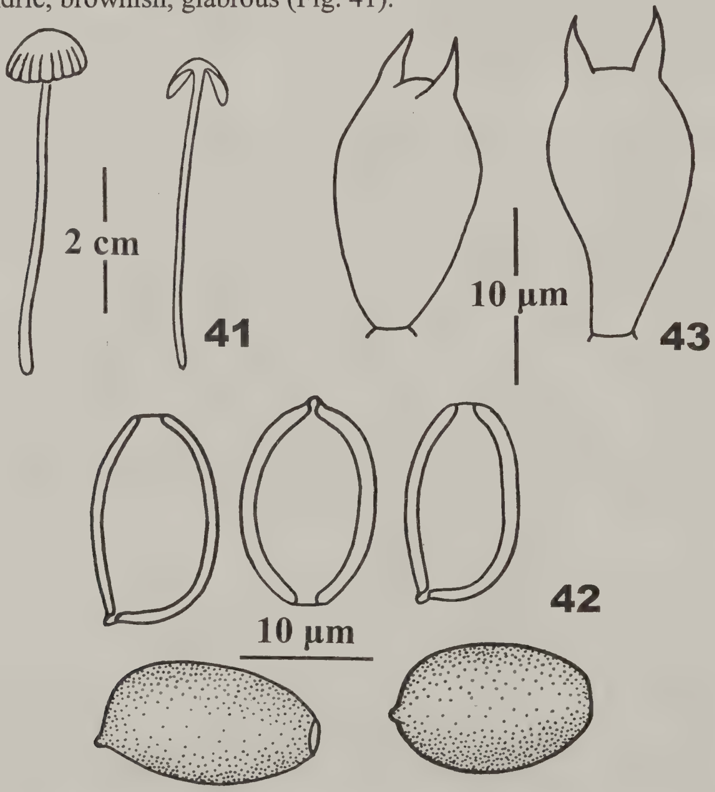
Fig. 40: Spores of *Flammula hanoiensis* (holotype).

Specimen Examined: Hanoi, Tonkin, Vietnam, Boutan 195 (Herb. Patouillard, FH 4339-holotype). On rotten grass.

Note: The holotype is in poor condition. In the above description the color and size of the basidiocarps are mainly based on Demange's colored illustrations. Judging by the illustrations, this may be a weathered specimen of *Gymnopilus dilepis* (Berk. & Br.) Singer, originally described from Sri Lanka (Pegler, 1986). For color variations of fruitbodies of *G. dilepis* see Petch (1907: 52).

16. *Galera fracticeps* Pat. & Dem., Bull. Soc. Mycol. France **26:** 41 (1910).

Pileus 1-1.5 cm in diam, conical-campanulate, grey, sometimes becoming dark brown along margin; margin long sulcate-striate, undulating. Lamellae near free, brown. Stipe 4-5 cm × 1-1.5 mm, subcylindric, brownish, glabrous (Fig. 41).



Figs. 41-43: *Galera fracticeps* (holotype). 41. Basidiocarps; 42. Basidiospores; 43. Basidia.

Spores [20/1/1] (11.0-)13.0-16.0 × 8.5-9.0 × 9.0-10.0(-11.0) µm [Q_1 = 1.53-1.88, $\mathbf{Q_1}$ = 1.72 ± 0.09; Q_2 = (1.16-)1.45-1.78, $\mathbf{Q_2}$ = 1.54 ± 0.16], ellipsoid to elongate in side view, ellipsoid to sometimes sub-hexagonal in ventral view, brown, reddish brown to fulvous-brown, thick-walled, with a truncate germ pore (Fig. 42). Basidia 15-23 × 8-12 µm, 2-spored, rarely 1-spored; sterigmata 4-6 µm long (Fig. 43). Pleurocystidia lacking. Cheilocystidia and caulocystidia not recovered. Pileipellis a non-stratified epithelium of broadly clavate to pyriform to subglobose cells, 20-30 × 15-20 µm, thin-walled, colorless, sometimes with yellow-brown, vacuolar pigment. Clamps not seen.

Specimen Examined: Hanoi, Tonkin, Vietnam, M. Demange 210 (Herb. Patouillard, FH 4367-holotype).

Note: In the above description the color and size of the basidiocarps are mainly based on Demange's colored illustrations. This taxon is a member of the genus *Conocybe*. Therefore, a new combination is made here: ***Conocybe fracticeps*** (Pat. & Dem.) Z. L. Yang, **comb. nov.** [Basionym: *Galera fracticeps* Pat. & Dem., Bull. Soc. Mycol. France **26:** 41 (1910)]. It is somewhat similar to *C. tenera*, but differs from the latter by its grey pileus, bispored basidia, and larger spores (see Pegler 1986: 396). Patouillard & Demange (1910) supposed that *C. fracticeps* is similar to *G. siliginea* (Fr.: Fr.) Kühner, but the latter has non-striate pileal margin, and smaller spores measuring 11-12 × 6.5-7 µm (Watling, 1982: 75). The habitus of *C. ambigua* Watling is similar to *C. fracticeps*, but the latter has differently colored fruitbodies, narrower and ± amygdaliform spores (Watling, 1982).

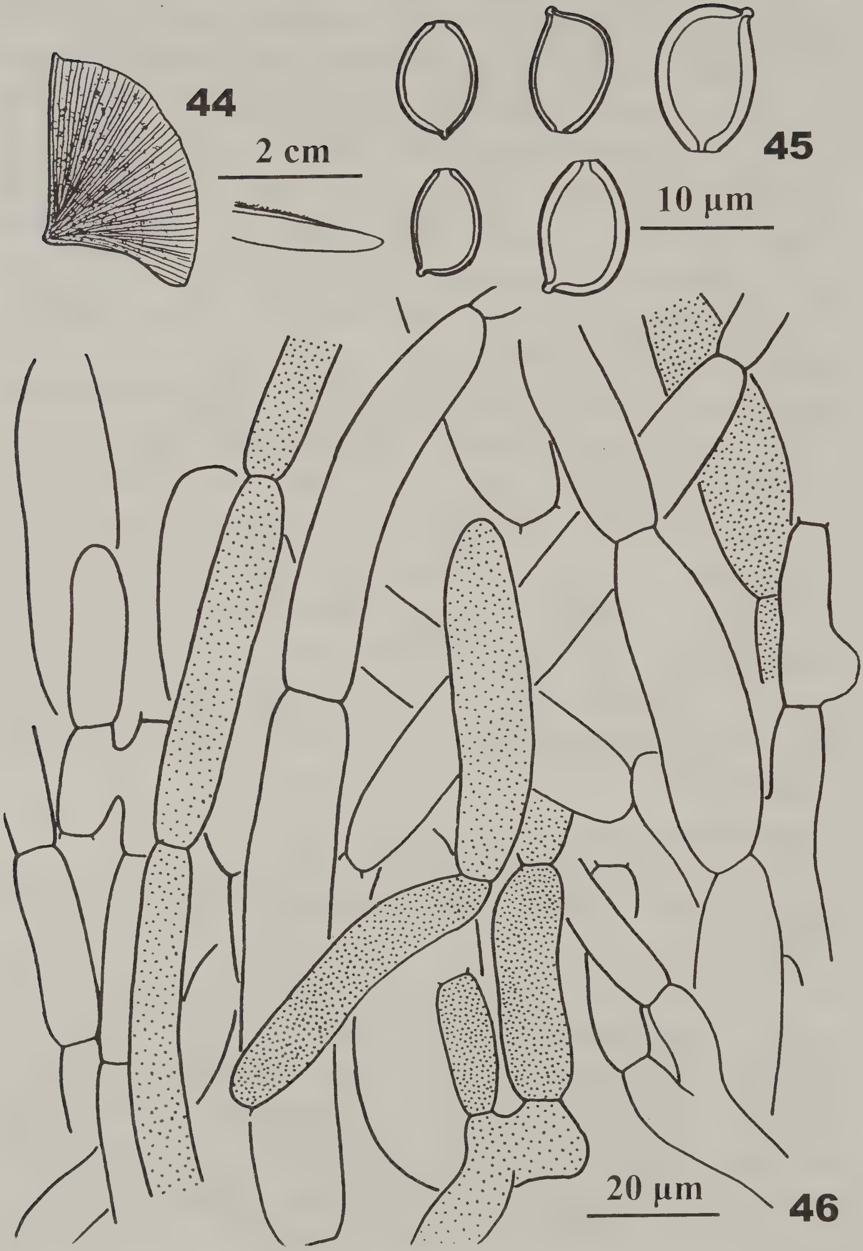
17. *Hiatula boniana* Pat., J. Bot. (Morot) **11:** 336 (1897).

Pileus ca 4-5 cm in diam, brownish, radially long striate, covered with dark grey to blackish, floccose squamules; context very thin (Fig.44).

Spores [25/1/1] 8.0-10.0(-11.0) × (5.0-)5.5-6.5(-7.5) µm [Q = 1.33-1.54(-1.73), **Q** = 1.46 ± 0.10], subamygdaliform, thick-walled, colorless hyaline, strongly dextrinoid, with a truncate germ pore (Fig. 45). Squamules on pileus made up of ± vertically to irregularly arranged, inflated cells (25-)40-70(-130) × 10-35 µm, long ellipsoid, rarely ovoid to subglobose, often in chains, thin-walled, hyaline to subhyaline or with grey, brownish grey, vacuolar pigment (Fig. 46). Clamps not observed.

Specimen Examined: Ke So, Hanoi, Tonkin, Vietnam, Bonn 4833 (Herb. Patouillard, FH 4034-holotype).

Note: The holotype consists of only two pieces of pileus. This taxon should be placed in the genus *Leucocoprinus* due to its long striate, thin


44
2 cm
45
10 µm
20 µm
46

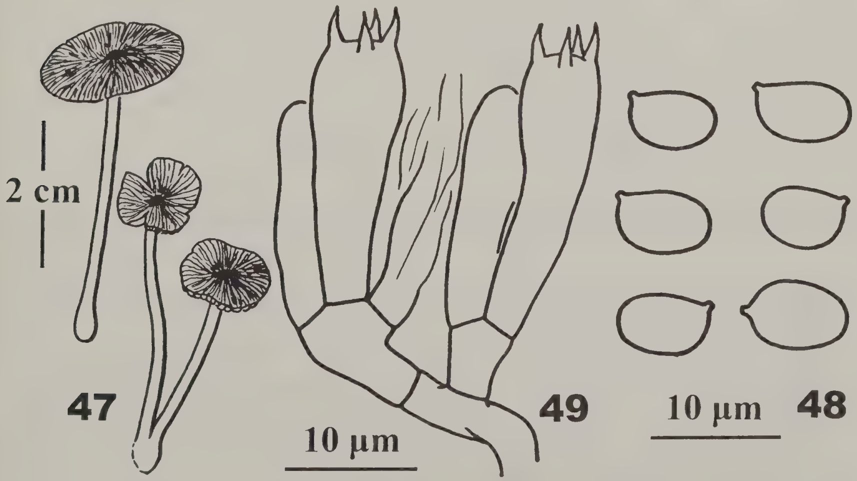
Figs. 44-46: *Hiatula boniana* (holotype). 44. Pileal fragments; 45. Basidiospores; 46. Squamules on pileus.

pileus, and strongly dextrinoid, thick-walled spores with a truncate germ pore. Thus, a new combination is made here: ***Leucocoprinus bonianus*** (Pat.) Z. L. Yang, **comb. nov.** [Basionym: *Hiatula boniana* Pat., J. Bot. (Morot) **11:** 336 (1897)]. *Leucocoprinus bonianus* is very closely related to *L. birnbaumii* (Corda) Singer (see Pegler, 1977: 317; 1986: 322), but differs from the latter by the long striated pileus and darker (?) colored veil remnants on the pileus.

18. *Hiatula tonkinensis* Pat., J. Bot. (Morot) **5:** 308 (1891).
= ***Termitomyces microcarpus*** (Berk. & Br.) Heim, Mém. Acad. Sci. Inst. France **64:** 72 (1941).

Pileus 0.5-1.5 cm in diam, greyish to brownish, radially innate fibrillose, often with a darker colored, acute papillate umbo at disc. Lamellae free. Stipe 2-4 × 0.1-0.3 cm, white to dirty white, without pseudorrhiza (Fig. 47).

Spores [30/1/1] 6.0-7.5 × 4.0-5.5 µm [Q = (1.27-)1.36-1.63, **Q** = 1.49 ± 0.09], ellipsoid, thin- to slightly thick-walled, colorless hyaline, inamyloid, not dextrinoid, lacking germ pore (Fig. 48). Basidia 17-23 × 6-8 µm, clavate, 4-spored (Fig. 49). Pleurocystidia 28-35 × 13-18 µm, broadly clavate to clavate, colorless hyaline, thin- to slightly thick-walled. Cheilocystidia similar to pleurocystidia. Pileipellis made up of repent, filamentous hyphae 3-12 µm wide, subhyaline or with brownish vacuolar pigment. Clamps lacking.



Figs. 47-49: *Hiatula tonkinensis* (holotype). 47. Basidiocarps; 48. Basidiospores; 49. Basidia.

Specimen Examined: Ke So, Hanoi, Tonkin, Vietnam, Bonn 4435 (Herb. Patouillard, FH 4435-holotype).
Note: This is apparently a synonym of *Termitomyces microcarpus* (Berk. & Br.) Heim, a species widely distributed in southeast Asia, southern China, and tropical Africa (Pegler, 1986: 331; Pegler & Vanhaecke, 1994: 732; Ying & Zang, 1994).

19. *Hygrophorus erinaceus* Pat., Bull. Soc. Mycol. France **25:** 10 (1909).
≡ ***Hygrocybe erinacea*** (Pat.) Singer, Sydowia **12:** 225 (1959).

Spores [20/1/1] dimorphous: macrospores 12.0-16.5(-18.0) × 7.0-10.0 µm [Q = 1.56-2.0(-2.2), **Q** = 1.80 ± 0.19], ellipsoid to subamygdaliform, colorless hyaline, thin-walled (Fig. 50); microspores 6.0-8.5 × 4.0-5.0(-5.5) µm [Q = (1.40-)1.50-1.89(-2.13), **Q** = 1.65 ± 0.17], subamygdaliform, sometimes ellipsoid, colorless hyaline, thin-walled (Fig. 50). Basidia dimorphous: large basidia 50-60 × 11-13 µm, clavate, 4-spored; sterigmata 7-12 µm long; basal septa with clamps. Small basidia 35-45 × 6-7.5 µm, clavate, 4-spored; sterigmata 4-5 µm long; basal septa with clamps. Squamules on pileus made up of subcylindrical cells (55-100 × 10-25 µm) in chains, with brown, vacuolar pigment.

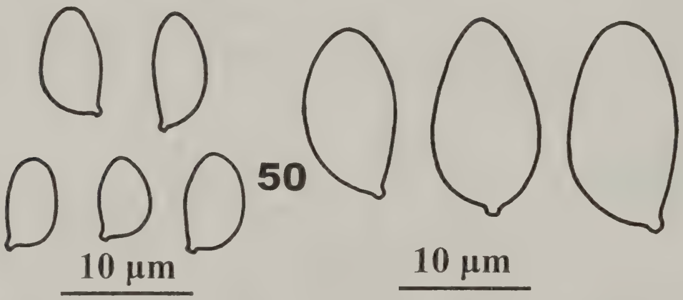


Fig. 50: Dimorphous basidiospores of *Hygrophorus erinaceus* (holotype).

Specimen Examined: Dalat, Dangkia, Annam, Vietnam, M. Eberhardt LBA 66 (Herb. Patouillard, FH 3967-holotype).
Note: The holotype of *Hygrophorus erinaceus* Pat. consists of only one fruitbody in poor condition. For macroscopic descriptions see Patouillard (1909: 10). The dimorphous spores call to mind the *Hygrocybe firma* complex (Corner, 1936; Pegler & Fiard, 1978). *Hygrocybe erinacea* (Pat.) Singer is very close to *H. anisa* (Berk. & Br.) Pegler (1986: 66) if they are not conspecific. The only difference between them is the presence of dark squamules on the pileus of *H. erinacea*. *Hygrophorus erinaceus*

sensu Petch (1917) is certainly a different taxon (see Pegler, 1986: 57). Singer (1959: 225) reported *H. erinacea* from Mexico and stated that it belongs in section and subsection *Conicae*. Because he gave no detailed description of his collection from Mexico, it is uncertain whether the Mexican fungus is identical with the eastern tropical mushroom or not.

20. *Hygrophorus miniatoalbus* Pat., Bull. Soc. Mycol. France **29:** 213 (1913).

≡ ***Hygrocybe miniatoalba*** (Pat.) Möller, Fungi Faeröes **1:** 154 (1945).

Pileus 1-1.5 cm in diam, often depressed at center, red to scarlet-red, sometimes slightly paler at disc, glabrous but center with fine squamules. Lamellae adnate to decurrent, white, crowded to subdistant, with lamelullae. Stipe 2-5 × 0.2-0.4 cm, yellowish with orange tinge, subcylindirc or attenuate towards base, fistulose.

Spores [25/2/1] (7.0-)7.5-9.0(-9.5) × (5.0-)5.5-7.0 µm [Q = (1.15-) 1.19-1.46(-1.70), **Q** = 1.30 ± 0.12], broadly ellipsoid to ellipsoid, thin-walled, smooth, colorless hyaline, inamyloid, non-dextrinoid (Fig. 51). Basidia 47-70 × 9-13 µm, clavate, 4-spored; sterigmata 5-7(-9) µm long; basal septa with clamps.

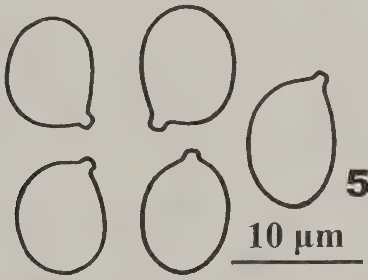


Fig. 51: Basidiospores of *Hygrophorus miniatoalbus* (holotype).

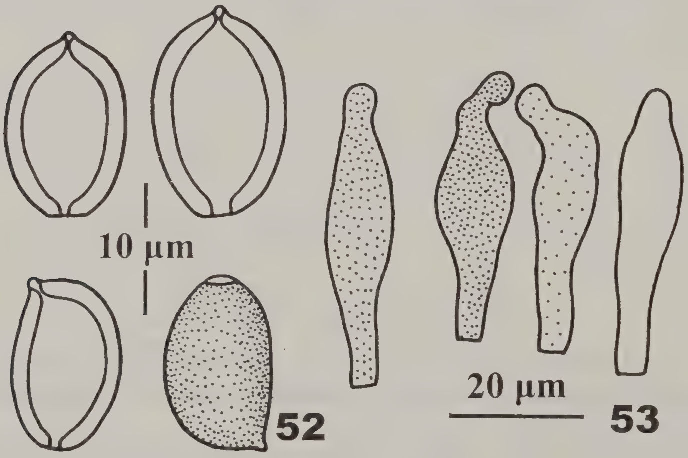
Specimen Examined: Thai Ha, Tonkin, Vietnam, M. Demange 367 (Herb. Patouillard, FH 3970-holotype). On soil.

Note: In the above description the color and size of the basidiocarps are mainly based on Demange's colored illustrations. The holotype specimen does not rehydrate well, thus microscopic studies were limited. *Hygrocybe miniatoalba* differs from *H. miniata,* originally described from Europe, by its wider, differently shaped spores, and white lamellae (see Boertmann, 1995). *Hygrocybe miniatoalba* is very similar to *H. cantharella* (Schw.: Fr.) Murrill, originally described from North America, but has white lamellae, proportionally shorter spores (see Arnolds, 1986; Boertmann, 1995; Bessette *et al.*, 1997).

21. *Hypholoma albosulfureum* Pat., J. Bot. (Morot) **5:** 309 (1891).

Pileus ca 6-10 cm in diam, convex to applanate, ochraceous or lightly darker, paler towards margin, surface often radially fissile. Lamellae adnexed (to adnate), brown. Stipe 7-12 × 1-1.2 cm, slightly attenuate upwards. Annulus membranous, whitish, pendant from 1-3 cm below apex of stipe.

Spores [40/2/2] (11.0-)12.5-15.0(-15.5) × 7.5-9.0(-9.5) × (7.0-)8.5-10.0(-10.5) µm [Q_1 = (1.44-)1.51-1.73, **Q_1** = 1.61 ± 0.08; Q_2 = (1.35-)1.40-1.57(-1.64), **Q_2** = 1.47 ± 0.07], ellipsoid, chocolate-brown, thick-walled (1-1.5 µm thick), with a truncate germ pore (Fig. 52). Basidia 25-30 × 8-10 µm, clavate, 4-spored. Pleurocystidia not observed. Cheilocystidia forming a sterile strip along lamellar edge, 35-50(-70) × 8-15 µm, subclavate, fusiform, subcapitate to capitate, thin-walled, hyaline to subhyaline or with yellowish contents (Fig. 53). Pileipellis of repent, radially arranged hyphae 3-5 µm wide, hyaline to subhyaline, slightly to strongly gelatinized. Hypodermium made up of filamentous hyphae, not forming a subcellular layer. Clamps not observed.



Figs. 52-53: *Hypholoma albosulfureum*.
52. Basidiospores (holotype); 53. Cheilocystidia (Bon 4917).

Specimens Examined: Vo Xa, Tonkin, Vietnam, Bon 4537 (Herb. Patouillard, FH 4428-holotype); Tonkin, Vietnam, Bon 4917 (Herb. Patouillard, FH 4428). On soil and debris of plants.

Note: The holotype collection of *Hypholoma albosulfureum* Pat. is in poor condition. Some microscopic characters (*e.g.* cheilocystidia) are from observations on Bon 4917. This taxon is a typical member of the genus *Stropharia* due to its gelatinized pileipellis, membranous annulus and probably non-lignicolous habit. Therefore, a new combination is made here: ***Stropharia albosulfurea*** (Pat.) Z. L. Yang, **comb. nov.** [Basionym: *Hypholoma albosulfureum* Pat., J. Bot. (Morot) **5:** 309 (1891)]. It is very similar to *S. rugosoannulata* Farlow ex Murrill, but the latter usually has larger basidiocarps, and differently shaped cheilocystidia (Breitenbach & Kränzlin, 1995: 354-355; Imazeki *et al.*, 1970: 94). *Naematoloma caerulescens* Pat., a more recent name, is conspecific with this species (see below).

22. *Lentinus mollipes* Pat., Bull. Soc. Mycol. France **33:** 54 (1917).

Pileus 6-8 cm in diam, nearly infundibuliform, reddish to brownish at center, paler towards margin, with brown, small squamules, glabrescent and paler towards margin. Lamellae decurrent, subdistant, white, 3-4 mm in height. Stipe central, 5 × 1 cm, subcylindric, greyish brown, densely covered with brown hairs or fibrils, radicating, with a pseudorrhiza. Context of pileus thin, whitish.

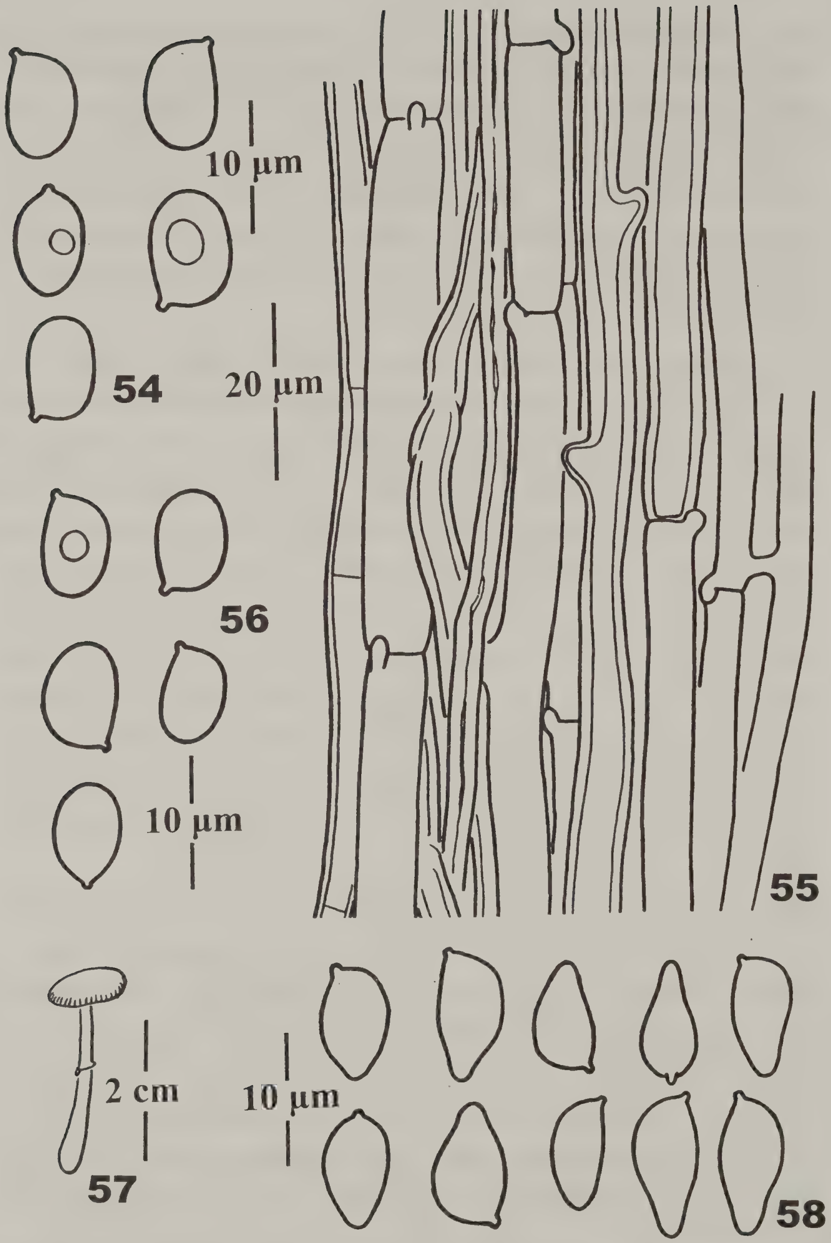
Spores [25/1/1] 7.5-9.0 × 5.0-6.0 µm [Q = 1.36-1.56(-1.63), **Q** = 1.48 ± 0.07], ellipsoid, thin-walled, colorless hyaline, inamyloid, often with a guttula (Fig. 54). Tramal hyphae of lamellae thin to slightly thick-walled (less than 0.5 µm), branching, anastomosing, rarely inflated; septa often with clamps. Cheilocystidia unrecovered. Trama of stipe dimitic: generative hyphae 3-10(-15) µm wide, thin- to slightly thick-walled (less than 0.5 µm thick), branching, with clamps; skeletal hyphae 2-4 µm wide, thick-walled (0.5-2 µm thick), rarely branched or septate (Fig. 55).

Specimen Examined: La Pho, Tonkin, Vietnam, M. Demange 382 (Herb. Patouillard, FH 3873-holotype).

Note: In the above description the color and size of the basidiocarps are mainly based on Demange's colored illustrations. Spores were measured from a spore-print accompanying the holotype specimen consisting of one basidiocarp in two longitudinal halves. The holotype does not rehydrate well. Pegler (1983: 247) studied the holotype, and concluded that this is not a species of *Lentinus*, but probably best placed in *Clitocybe*. My observations reveal that *Lentinus mollipes* is conspecific with *Lentinus giganteus* Berk. which was placed in *Panus* by Corner (1981: 69).

23. ***Lepiota albocitrina*** Pat., Bull. Soc. Mycol. France **8:** 46 (1892).

Pileus ca 1 cm in diam; pileal margin short striate. Stipe 2 × 0.2 cm, attenuate upwards; annulus almost median (Fig. 57).


10 µm
54
20 µm
56
10 µm
55
57
2 cm
10 µm
58

Figs.54-55:*Lentinus mollipes* (holotype). 54.Basidiospores; 55.Trama of stipe. Fig. 56. Basidiospores of *Pleurotus radicosus* (holotype). Figs. 57-58: *Lepiota albocitrina* (holotype). 57. Basidiocarp; 58. Basidiospores.

Spores [30/1/1] 8.0-10.0(-10.5) × (4.0-)4.5-5.5(-6.0) µm [Q = (1.5-) 1.55-2.0(-2.19), **Q** = 1.82 ± 0.18], amygdaliform to sub-amygdaliform, thin-walled to slightly thick-walled (less than 0.5 µm), colorless hyaline, strongly dextrinoid, without germ pore (Fig. 58). Basidia 20-25 × 7-8 µm, clavate to narrowly clavate. Cheilocystidia 35-50 × 7-10 µm, caespitose, crowded, clavate to subcylindric, thin-walled, hyaline. Clamps not seen.

Specimen Examined: Ninh Thai, Tonkin, Vietnam, Bon *s. n.* (Herb. Patouillard, FH 4222-holotype).

Note: The holotype consists of only one fruitbody. It is a member of the genus *Lepiota s.l.* Because ornaments on the pileus ("echinate-pulverulent" veil remnants) have disappeared, its systematic position is uncertain.

24. *Lepiota anceps* Pat., Bull. Soc. Mycol. France **33:** 60 (1917)

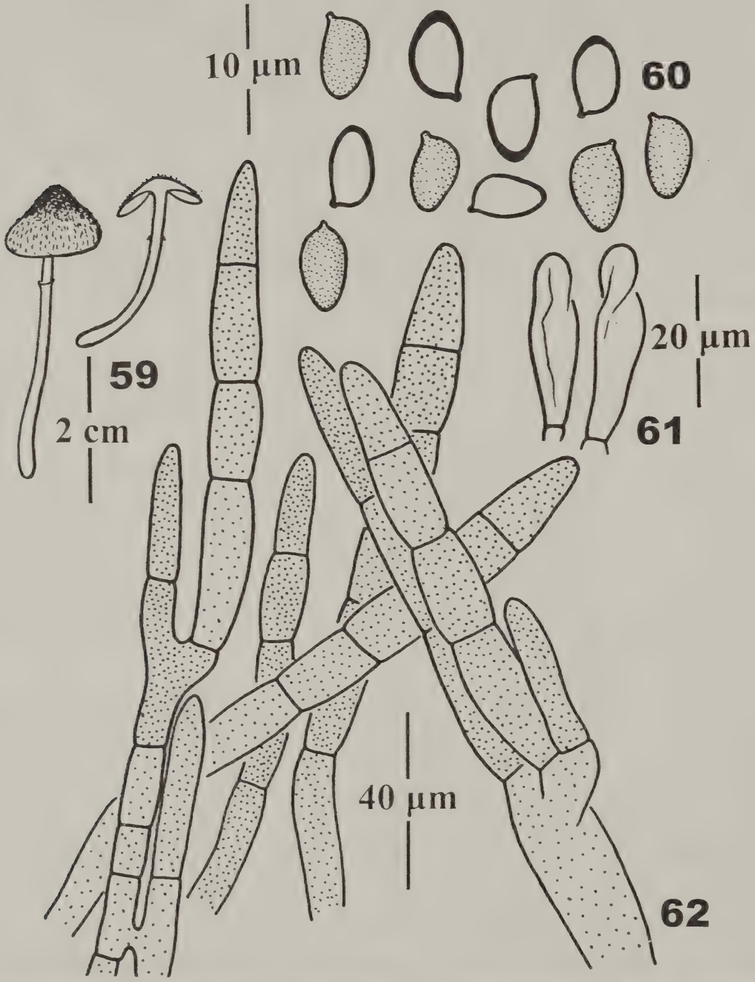
? = ***Micropsalliota erythrospila*** (Berk. & Br.) Pegler, Kew Bull. Addit. Ser. **12:** 331, fig. 72 A-C (1986).

Pileus 1-2 cm in diam, subconical to subcampanulate, sometimes becoming applanate when mature, purple-red, pink-red, darker at disc, covered with floccose to subtomentose squamules over the disc, squamules becoming repent and fibrillose toward the margin. Lamellae free, brownish to brown. Stipe 2.5-3.5 × 0.1-0.2 cm, white to dirty white, with pinkish tinge. Annulus 0.5-0.8 cm below apex of stipe, white to dirty white (Fig. 59).

Spores [40/2/1] 5.0-6.5(-7.0) × 3.0-4.0 µm [Q = (1.43-)1.56-1.86 (-2.0), **Q** = 1.68 ± 0.11], subamygdaliform, occasionally ellipsoid, fuscous-brown, thick-walled, lacking germ pore, apex of spores often thicker than other places (Fig. 60). Basidia 10-20 × 5.5-7 µm, clavate to subclavate, 4-spored. Cheilocystidia 15-30 × 4-8(-12) µm, clavate to subcylindric, sometimes capitate, hyaline, thin-walled (Fig. 61). Squamules over pileal disc made up of ± vertically to irregularly arranged, towards pileal margin repent hyphae (3-)8-15(-20) µm wide, frequently septated, with brown to greyish brown, vacuolar pigment (Fig. 62). Clamps lacking.

Specimen Examined: Hanoi, Tonkin, Vietnam, Demange 267 (Herb. Patouillard, FH 4233-holotype).

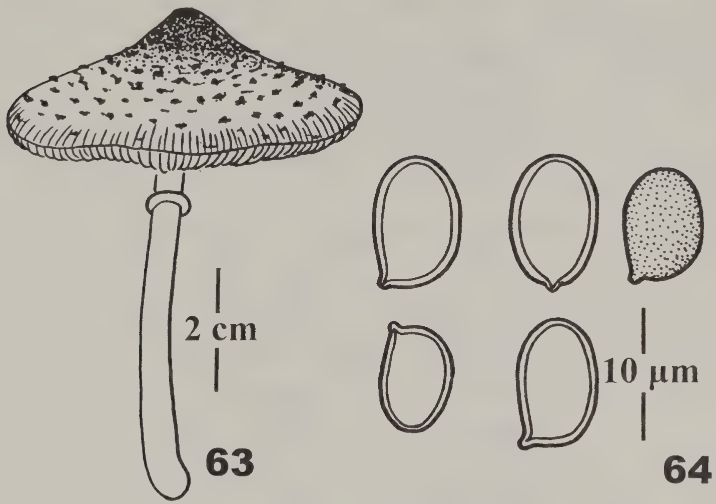
Note: In the above description the color and size of the basidiocarps are mainly based on Demange's colored illustrations. Judging by the illustrations and the microscopic features observed, this taxon is apparently a member of *Micropsalliota*, and probably a synonym of *M. erythrospila* (Berk. & Br.) Pegler (see Pegler, 1986: 331). *Micropsalliota* *gracilis* Heinem. is similar to this species, but differs by the darker stipe and lutescent context (see Heinemann, 1980: 60).



Figs. 59-62: *Lepiota anceps* (holotype). 59. Basidiocarps; 60. Basidiospores; 61. Cheilocystidia; 62. Squamules over pileal disc.

25. ***Lepiota demangei*** Pat., Bull. Soc. Mycol. France **23:** 78 (1907).

Pileus 2.5-5.5 cm in diam, convex, umbonate, white to cream-colored, covered with concentrically arranged, ochraceous to yellowish brown squamules, margin finely striate. Lamellae free, white to cream-colored, 5-7 mm in height. Stipe 5-6 × 0.2-0.5 cm, whitish, becoming yellowish to brownish when bruising; annulus 1-1.5 cm below apex of stipe, persistent. Context of pileus and stipe white, but becoming reddish, pinkish or orange red when injured. Spore print white (Fig. 63).



Figs. 63-64: *Lepiota demangei* (holotype).
63. Basidiocarp; 64. Basidiospores.

Spores [45/2/1] (7.5-)8.0-10.5(-12.5) × (5.0-)5.5-7.0(-7.5) µm [Q = (1.31-)1.42-1.69(-1.79), **Q** = 1.53 ± 0.09], ellipsoid, colorless hyaline, strongly dextrinoid, slightly thick-walled, apex lacking germ pore but somewhat thinner than other areas (Fig. 64). Basidia 25-30 × 7-9 µm, clavate, 4-spored. Squamules on pileus probably a hymeniform layer, made up of narrowly clavate to clavate cells 35-70 × 7-18 µm, with brownish, vacuolar pigment. Clamps not observed.

Specimen Examined: Hanoi, Tonkin, Vietnam, M. Demange 236 (Herb. Patouillard, FH 4244-holotype).

Note: In the above description the color and size of the basidiocarps are mainly based on Demange's colored illustrations. The holotype specimen consists of two vertical slices of different basidiomes, together with two spore prints. The two slices of basidiomes do not rehydrate well, so the structure of squamules on the pileus is not well known. This species is similar to *Lepiota epicharis* (Berk. & Br.) Sacc, but differs from the latter by its white to cream-colored lamellae, and ellipsoid, larger spores (Pegler, 1972: 163; 1986: 289). In addition, the discoloration of basidiocarps of *L. demangei* is also characteristic.

26. *Lepiota luteola* Pat., Bull. Soc. Mycol. France **8:** 46 (1892).

? = ***Leucocoprinus fragilissimus*** (Rav.) Pat., Essai Taxon.: 171 (1900).

Pileus 0.8 cm in diam, context very thin. Stipe 3 × 0.1-0.2 cm, subcylindric, annulate.

Spores [25/1/1] (9.0-)9.5-12.0 × 7.0-8.5(-9.0) µm [Q = (1.22-)1.25-1.47, **Q** = 1.34 ± 0.07], ellipsoid to broadly ellipsoid, thick-walled, colorless hyaline, dextrinoid, with a truncate germ pore, sometimes constricted apically into a short subcylindric region and terminated by a germ pore (Fig. 65).

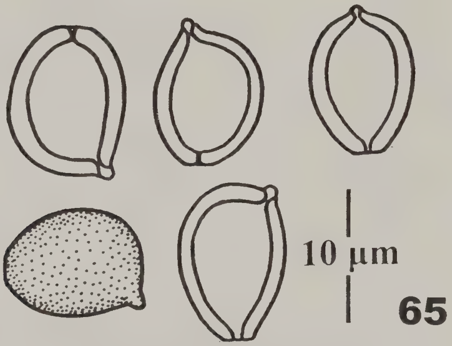


Fig. 65: Basidiospores of *Lepiota luteola* (holotype).

Specimen Examined: Ninh Thai, Tonkin, Vietnam, Bon *s.n.* (Herb. Patouillard, FH 4256-holotype).

Note: The holotype is in poor condition. The structure of the squamules (veil remnants) on pileus could not be studied. This taxon may be a member of *Leucocoprinus*, in which genus it is very similar to *L. fragilissimus* (Rav.) Pat. The only difference is the shape of the apex of the spores as compared with the illustrations of Smith & Weber (1982: Pl. 3/1C), and Pegler (1986: fig. 71/f).

27. ***Lepiota nigricans*** Pat., Bull. Soc. Mycol. France **8:** 46 (1892).

Pileus ca 1 cm in diam, convex to applanate, brownish or darker, covered with darker squamules. Lamellae and stipe darker-colored. Annulus pendant from ca 1 cm below apex of stipe.

Spores [15/1/1] 5.0-6.0(-6.5) × (3.0-)3.5-4.0 µm [Q = 1.43-1.58 (-1.66), **Q** = 1.54 ± 0.06], ellipsoid, slightly thick-walled, colorless hyaline, strongly dextrinoid; germ pore lacking or invisible, sometimes the apex somewhat truncate (Fig. 66). Cheilocystidia not recovered.

Specimen Examined: Ninh Thai, Tonkin, Vietnam, Bon *s.n.* (Herb.

Patouillard, FH 4264-holotype).
Note: The holotype of *Lepiota nigricans* is in poor condition. Squamules on the cap could not be studied in detail.

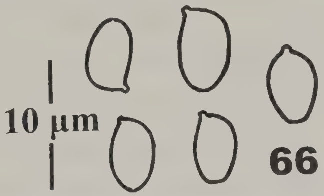
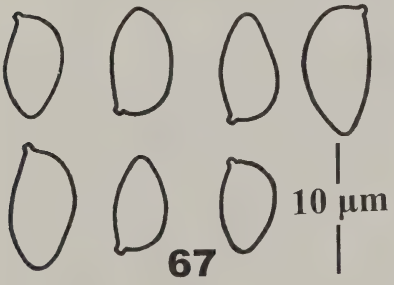


Fig. 66: Basidiospores of *Lepiota nigricans* (holotype).

28. *Lepiota tonkinensis* Pat., Bull. Soc. Mycol. France **8:** 46 (1892).
= ***Leucoagaricus rubrotinctus*** (Peck) Singer, Sydowia **2:** 36 (1948).

Pileus ca 3 cm in diam, convex to applanate, with brownish red, appressed, fibrillose squamules. Lamellae free. Stipe 5 × 0.3-0.5 cm, slightly attenuate upwards; annulus almost median.

Spores [30/1/1] (6.0-)7.0-9.5 × 4.0-5.0 µm [Q = (1.5-)1.56-1.90 (-1.98), **Q** = 1.72 ± 0.13], subamygdaliform, thin-walled to slightly thick-walled, colorless hyaline, strongly dextrinoid, without germ pore (Fig. 67). Cheilocystidia 30-50 × 8-10 µm, caespitose, crowded, clavate to subfusiform, thin-walled, hyaline. Pileipellis (the repent squamules) made up of filamentous hyphae 3-10(-15) µm wide, frequently septate, with vacuolar, brown pigment. Clamps not seen.



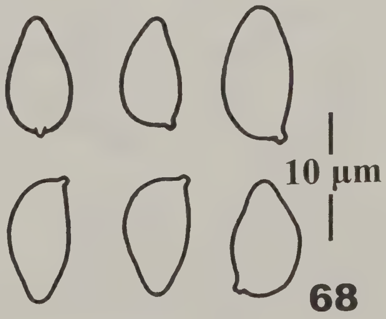
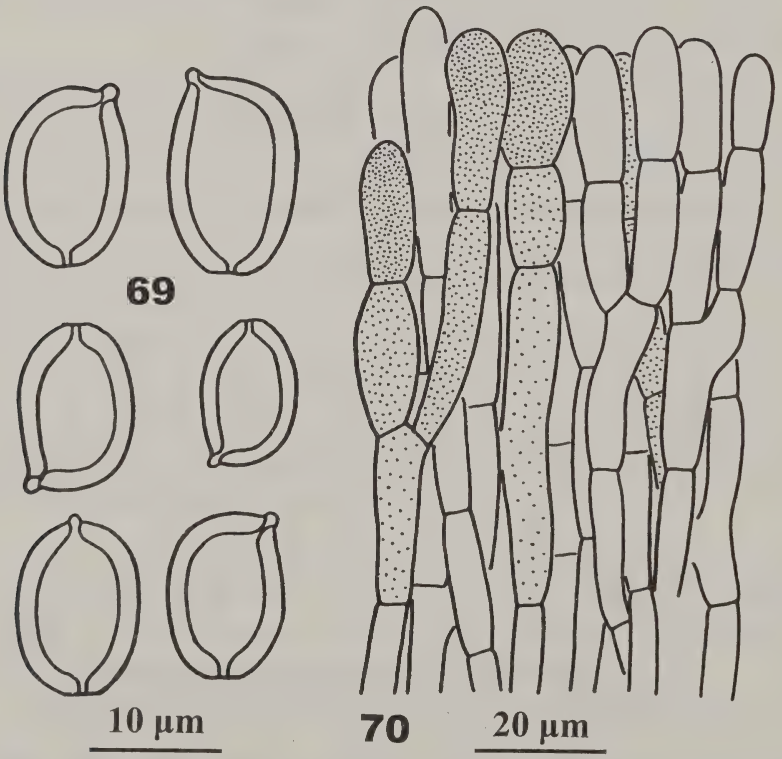


Fig. 67. Basidiospores of *Lepiota tonkinensis* (holotype).
Fig. 68: Basidiospores of *Leucoagaricus rubrotinctus* (Burt *s.n.*-FH)

Specimen Examined: Ninh Thai, Tonkin, Vietnam, Bon 4737 (Herb. Patouillard, FH 4275-holotype).

Note: *Lepiota tonkinensis* is a synonym of *Leucoagaricus rubrotinctus* (Peck) Singer. I compared the holotype of *L. tonkinensis* with a collection of *L. rubrotinctus* (Fig. 68) [USA: Middlebury, Vermont, July 26, 1897, E. A. Burt *s.n.* (FH)]. No significant differences between them could be found. *Leucoagaricus rubrotinctus* seems to be widely distributed in East Asia, including Japan and China. It was usually treated as *Lepiota japonica* Kawam. ex Hongo or *Leucoagaricus japonicus* (Kawam. ex Hongo) Hongo (Imazeki *et al.*, 1970; Ying & Zang, 1994). *Lepiota erythrogramma* looks like this species, but differs from the latter by its smaller spores, the cheilocystidia with a brown, vacuolar pigment and the presence of clamps (see Pegler 1972: 184; 1986: 311).

29. *Leucocoprinus dolichaulus* var. *cryptocyclus* Pat., Bull. Soc. Mycol. France **29:** 215 (1913).



Figs. 69-70: *Leucocoprinus dolichaulus* var. *cryptocyclus* (holotype). 69. Basidiospores; 70. Squamules on pileus.

≡ *Lepiota dolichaula* var. *cryptocyclus* (Pat.) Sacc. & Trott., Syll. Fung. **23:** 23 (1925).

= ***Macrolepiota dolichaula*** (Berk. & Br.) Pegler & Rayner, Kew Bull. **23:** 368 (1969).

Pileus 8-10 cm in diam, convex to applanate, umbonate, white to whitish, covered with minute, brown squamules.

Spores [30/1/1] (11.0-)12.0-15.0(-17.0) × (7.0-)8.0-10.0(-10.5) µm [Q = (1.40-)1.44-1.65, **Q** = 1.52 ± 0.08], ellipsoid, thick-walled, colorless hyaline, strongly dextrinoid, with an apical germ pore (Fig. 69). Squamules on pileus a trichoderm made up of ± vertically arranged, hyphal segments 20-60 × 7-15 µm, ellipsoid to sub-ellipsoid, thin-walled, nearly colorless or with brownish to brown, vacuolar pigment (Fig. 70). Clamps not observed.

Specimen Examined: La Pho, Tonkin, Vietnam, M. Demange 346 (Herb. Patouillard, FH 4246-holotype).

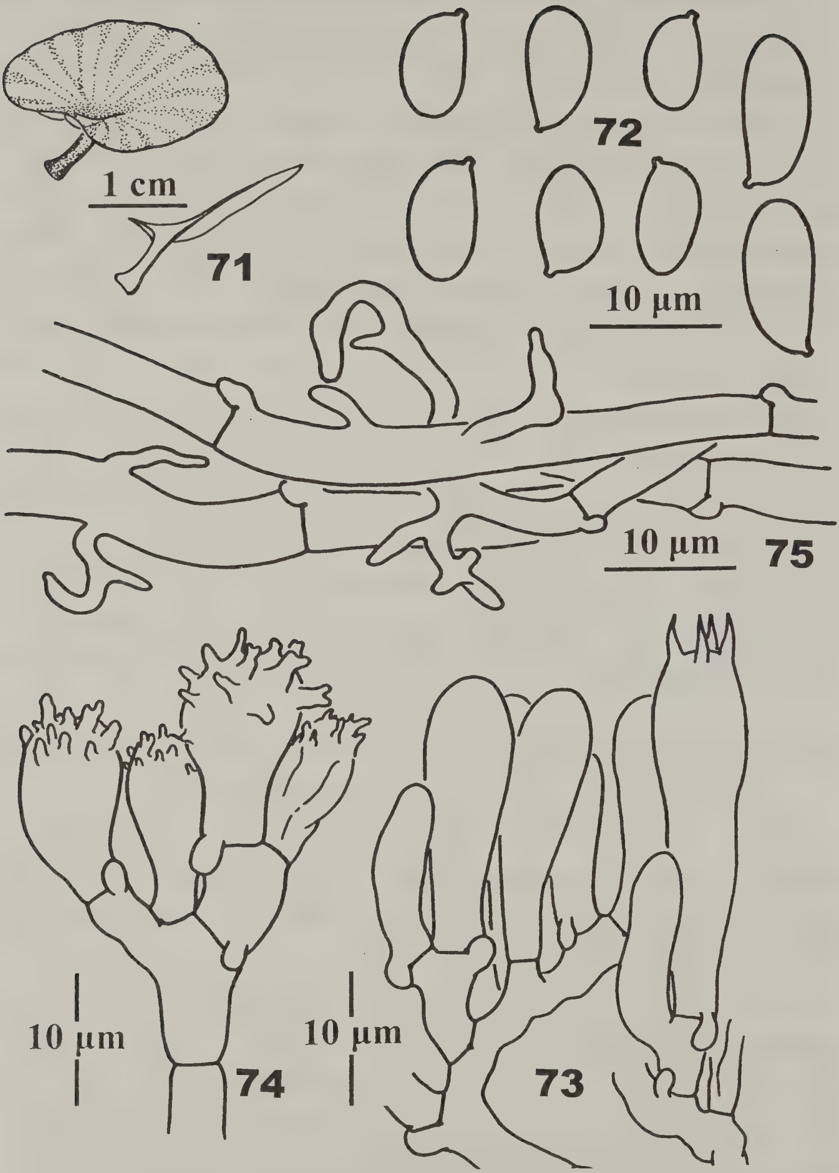
Note: This taxon is a typical member of *Macrolepiota*. As Pegler (1986: 320) stated, Patouillard's var. *cryptocyclus* appears to differ only in the high insertation of the annulus on the stipe. Because the annulus of many *Macrolepiota* species are often moveable, it is reasonable to treat *Leucocoprinus dolichaulus* var. *cryptocyclus* Pat. as a synonym of *Macrolepiota dolichaula* (Berk. & Br.) Pegler & Rayner, also occurring in tropical Yunnan, China according to my collections.

30. *Marasmius nigripes* Pat., J. Bot. (Morot) **11:** 337 (1897), *non Marasmius nigripes* (Schw.) Fr., Epicrisis: 383 (1838).

≡ *Marasmius patouillardi* Sacc. & Syd., Syll. Fung. **14:** 113 (1899).

Pileus 6-20 mm in diam, white to cream-colored, with long radial striations. Lamellae adnate to decurrent, distant to subdistant, 1-2(-3) ranks. Stipe strongly eccentric, 3-8 × 1-2 mm, apex whitish, becoming dark-grey to blackish towards base (Fig. 71).

Spores [35/1/1] (7.5-)8.0-11.5(-14.0) × (4.0-)4.5-6.0(-7.0) µm [Q = (1.56-)1.6-2.0(-2.3), **Q** = 1.85 ± 0.2], elongate, thin-walled, smooth, colorless hyaline, inamyloid (Fig. 72). Basidia 22-30 × 7-9 µm, clavate, 4-spored; sterigmata 4-5 µm long; basal septa with clamps (Fig. 73). Cheilocystidia 13-23 × 7-10 µm, clavate to broadly clavate, hyaline, thin-walled, apex or its upper part with fine outgrowths (Fig. 74). Surface of stipe made up of longitudinally arranged filamentous hyphae 2-7 µm wide, with greyish to olivaceous, thickened wall (up to 2 µm thick). Pileipellis a repent epicutis made up of ± radially arranged hyphae 3-7 µm wide, often with a coralloid or *Rameales*-structure, hyaline, thin-walled (Fig. 75). Clamps common.


1 cm
71
72
10 µm
10 µm
75
10 µm
10 µm
74
73

Figs. 71-75: *Marasmius nigripes* Pat. (holotype). 71. Basidiocarps; 72. Basidiospores; 73. Basidia; 74. Cheilocystidia; 75. Pileipellis.

Specimen Examined: Vo Xa, Hanoi, Tonkin, Vietnam, Bon 4898 (Herb. Patouillard, FH 4183-holotype).

Note: In the protologue, the spores were wrongly described as ovoid, 7 × 5-6 μm (Patouillard, 1897a: 338). According to its microscopic characters, this taxon belongs to *Marasmiellus*. Thus a new combination is made: ***Marasmiellus patouillardi*** (Sacc. & Syd.) Z. L. Yang, **comb. nov.** [Basionym: *Marasmius patouillardi* Sacc. & Syd., Sacc., Syll. Fung. **14:** 113 (1899)]. *Marasmiellus purpureoalbus* (Petch) Singer, described from Sri Lanka, is very similar to *M. patouillardi*. The former differs from the latter only by the white stipe, somewhat colored pileus, and slightly longer spores (see Petch, 1947; Pegler, 1986).

31. *Marasmius tonkinensis* Pat., J. Bot (Morot) **5:** 307 (1891).

Pileus 1 cm wide, flabelliform to orbicular, whitish. Lamellae white, distant, reticulate. Stipe 1 × 0.1-0.2 cm, eccentric, cylindric, insititious.

Spores [15/1/1] (10.0-)11.0-14.0 × 3.0-4.0(-4.5) μm [Q = 3.11-4.0 (-4.17), **Q** = 3.54 ± 0.35], clavate to fusiform, often slightly curved, thin-walled, smooth, colorless hyaline, inamyloid (Fig. 76). Pileal margin with hairs, 50-55 × 5-6 μm, subcylindric, apex broadly rounded, hyaline, thin-walled. Pileipellis gelatinized.

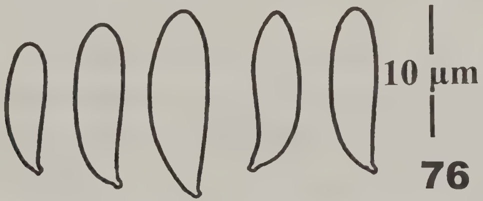


Fig. 76: Basidiospores of *Marasmius tonkinensis* (holotype).

Specimen Examined: Tonkin, Vietnam, M. Bon 3448 (Herb. Patouillard, FH 4202-holotype).

Note: Because the holotype, consisting of only one fruitbody, is in poor condition, its cheilocystidia and pileipellis could not be studied. This is probably a *Marasmiellus*, and very similar to *M. calami* (Petch) Singer (see Pegler, 1986: 102).

32. *Naematoloma caerulescens* Pat., Bull. Soc. Mycol. France **23:** 78 (1907).

≡ *Hypholoma caerulescens* (Pat.) Sacc. & Trott., Syll. Fung. **21:** 212 (1912).

≡ ***Stropharia albosulfurea*** (Pat.) Z. L. Yang in the present paper.

Pileus ca 4 cm in diam, convex. Lamellae adnexed to adnate, dark brown. Stipe 6-7 × 0.4-0.6 cm, subcylindric, or attenuate upwards; annulus membranous. Spore print dark fuscous-brown.

Spores [20/1/1] 12.0-14.5(-16.0) × 8.5-9.5 × 9.0-10.0 µm [Q_1 = 1.41-1.59(-1.61), $\mathbf{Q_1}$ = 1.52 ± 0.07; Q_2 = 1.26 - 1.56(-1.60), $\mathbf{Q_2}$ = 1.43 ± 0.10], ellipsoid, chocolate-brown, thick-walled (1-1.5 µm thick), with a truncate germ pore. Basidia 25-30 × 8-10 µm, clavate, 4-spored. Cheilocystidia forming a sterile strip along lamellar edge, 25-35 × 7-10 µm, subfusiform, usually capitate, hyaline, thin-walled, sometimes with yellow contents.

Specimen Examined: Hanoi, Tonkin, Vietnam, M. Demange *s.n.* (Herb. Patouillard, FH 4430-holotype). On sandy soil.

Note: The holotype collection of *Naematoloma caerulescens* Pat. consists of only two, vertical slices of a fruitbody on a paper, a spore-print, and a colored illustration of fruitbodies. But the characters of both the spores and the cheilocystidia, together with the accompanying illustration, leaves no doubt that it is identical with *Hypholoma albosulfureum* (≡ ***Stropharia albosulfurea***, see above). The pileipellis could not be studied, because the sections of holotype are very thin.

33. *Panaeolus bubalorum* Pat., J. Bot. (Morot) **11:** 339 (1897).

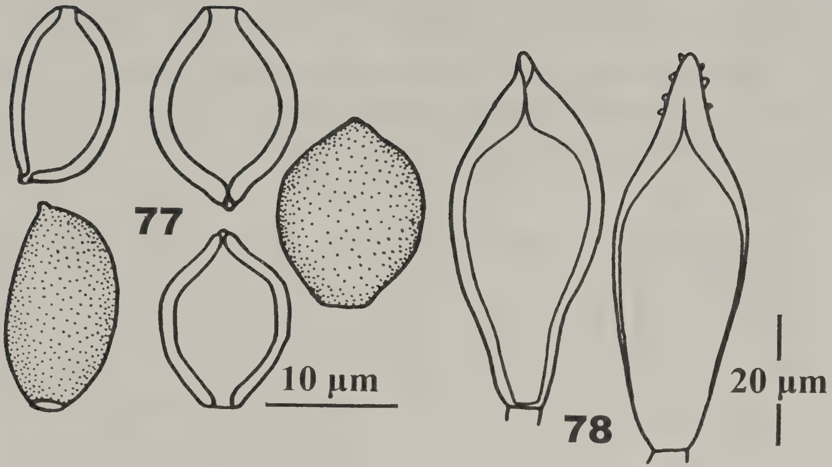
= ***Panaeolus cyanescens*** (Berk. & Br.) Sacc., Syll. Fung. **5:** 1123 (1887).

Pileus 1.5-4.5 cm in diam, campanulate, convex to applanate, often umbonate, dark brown, dark grey to black. Lamellae adnate, crowded, black. Stipe 5-9.5 × 0.2-0.5 cm, subcylindric, dark brown to black.

Spores [80/4/2] (11.0-)11.5-15.0(-16.0) × 7.0-9.0(-10.0) × (8.0-)9.0-12.0(-12.5) µm [Q_1 = (1.33-)1.37-1.79(-1.86), $\mathbf{Q_1}$ = 1.63 ± 0.13; Q_2 = (1.19-)1.22-1.44(-1.58), $\mathbf{Q_2}$ = 1.32 ± 0.09], ellipsoid in side view, lenticular, limoniform to sub-hexagonal in ventral view, blackish brown, thick-walled, with a truncate germ pore (Fig. 77). Pleurocystidia abundant, metuloid, 45-60 × 12-22 µm (Fig. 78). Cheilocystidia not recovered. Pileipellis an epithelium of subglobose to pyriform cells (30-45 × 25-35 µm), thin-walled, hyaline. Pileocystidia not recovered.

Specimens Examined: Vo Xa, Hanoi, Vietnam, Bon 4561 (Herb. Patouillard, FH 4401-lectotype, designated here) & 4539 (Herb. Patouillard, FH 4401).

Note: Patouillard (1897b) cited two collections Bon 4539 and 4561 under *Panaeolus bubalorum*. Bon 4561 is designated here as lectotype. Gerhardt (1996) suggested *P. bubalorum* is identical with *P. cyanescens* (Berk. & Br.) Sacc. I agree with what he treated.



Figs. 77-78: *Panaeolus bubalorum* (lectotype).
77. Basidiospores; 78. Pleurocystidia.

34. *Pleurotus radicosus* Pat., Bull. Soc. Mycol. France **33:** 56 (1917), *non Lentinus radicosus* Pat., Agricult. prat. Pays Chauds **1:** 264, pl. 2/3 (1901).

= ***Lentinus giganteus*** Berk., Hooker Lond. Journ. Bot. **6:** 493, pl. 17-18/2 (1847).

Pileus 7-13 cm in diam, convex to almost applanate, often depressed at disc, blackish over center, becoming grey to brownish towards margin, with darker, radially fibrillose squamules. Lamellae decurrent, moderately crowded to subdistant, white, 3 mm in height. Stipe central, radicating, 5-10 × 0.5-1.5 cm, subcylindric, grey to dark grey, with whitish hairs. Context of pileus and stipe white to whitish.

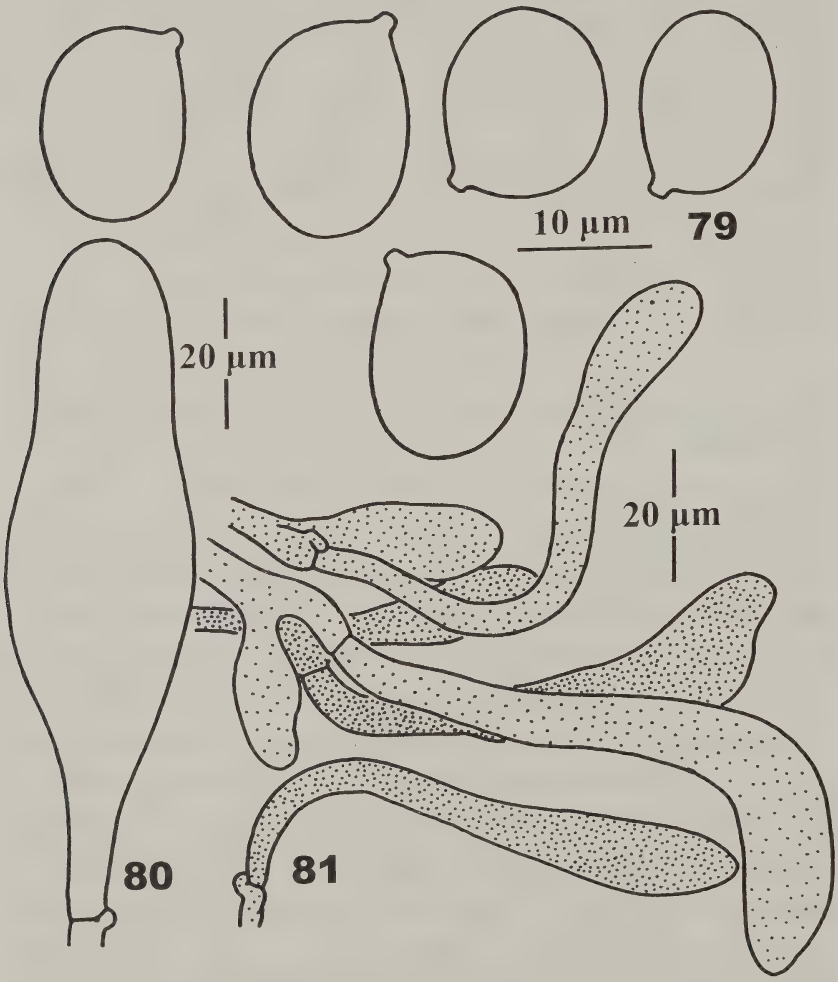
Spores [25/1/1] 7.0-9.0 × 5.0-6.0 µm [Q = (1.36-)1.40-1.60(-1.66), **Q** = 1.49 ± 0.06], ellipsoid, thin-walled, colorless hyaline, inamyloid, often with a guttula (Fig. 56). Basidia 20-26 × 6-8 µm, clavate, 4-spored, with basal clamps. Context dimitic: generative hyphae 3-15 µm wide, thin-walled, with lamps; skeletal hyphae 3-5 µm wide, thick-walled.

Specimen Examined: La Pho, Tonkin, Vietnam, M. Demange 343 (Herb. Patouillard, FH 3803-holotype).

Note: In the above description the color and size of the basidiocarps are mainly based on Demange's colored illustrations. *Pleurotus radicosus* Pat. is apparently conspecific with *Lentinus giganteus* Berk. [see Corner, 1981, as *Panus giganteus* (Berk.) Corner; Pegler, 1983 & 1986].

35. *Pluteus neurodermus* Pat., Bull. Soc. Mycol. France **25:** 11, Pl. 2/2 (1909).

Pileus ca 1 cm in diam, convex-applanate, blackish. Stipe ca 5.5 × 0.1-0.3 cm, subcylindric or attenuate upwards, with minute, dark brown to brown, furfuraceous squamules; base imperfect.



Figs. 79-81: *Pluteus neurodermus* (holotype). 79. Basidiospores; 80. Pleurocystidium; 81. Caulocystidia on lower part of stipe.

Spores [20/1/1] (13.0-)14.0-17.0(-19.0) × (10.0-)10.5-12.5 µm [Q = (1.17-)1.20-1.48(-1.52), **Q** = 1.32 ± 0.09], broadly ellipsoid to ellipsoid, colorless hyaline, inamyloid, thin-walled, smooth (Fig. 79). Basidia not recovered. Pleurocystidia abundant, 80-100 × 20-28 µm, long ellipsoid, clavate to fusiform; apex broadly rounded, often with yellow-brown incrustations (Fig. 80). Cheilocystidia crowded, 50-70 × 5-15 µm, clavate, subcylindrical to fusiform, hyaline, thin-walled. Pileipellis an epithelium made up of sphaeropedunculate to broadly clavate, sometimes clavate, thin-walled cells (30-50 × 15-20 µm) often with vacuolar brown pigment, sometimes nearly colorless. Caulocystidia gregarious to caespitose or fascicular, clavate to subfusiform (60-170 × 12-22 µm) to subcylindric (80-120 × 8-10 µm), with brown, ochraceous, vacuolar pigment (Fig. 81). Clamp connections common.

Specimen Examined: Annam, Tonkin, Vietnam, Eberhardt 93 (Herb. Patouillard, FH 4302-holotype).

Note: This taxon is a member of the genus *Oudemansiella*. Thus a new combination is proposed here: ***Oudemansiella neuroderma*** (Pat.) Z. L. Yang, **comb. nov.** [Basionym: *Pluteus neurodermus* Pat., Bull. Soc. Mycol. France **25:** 11 (1909)]. *Oudemansiella endochorda* (Berk. & Br.) Pegler and *O. altissima* (Mass.) Corner are similar to this species. However, the caulocystidia of *O. altissima* are distinctive (see Corner, 1994: Fig. 2), and the stipe of *O. endochorda* is lilac-grey to brown, with conspicuous transverse zoning (Pegler, 1986: 132; Pegler & Young, 1986: 594).

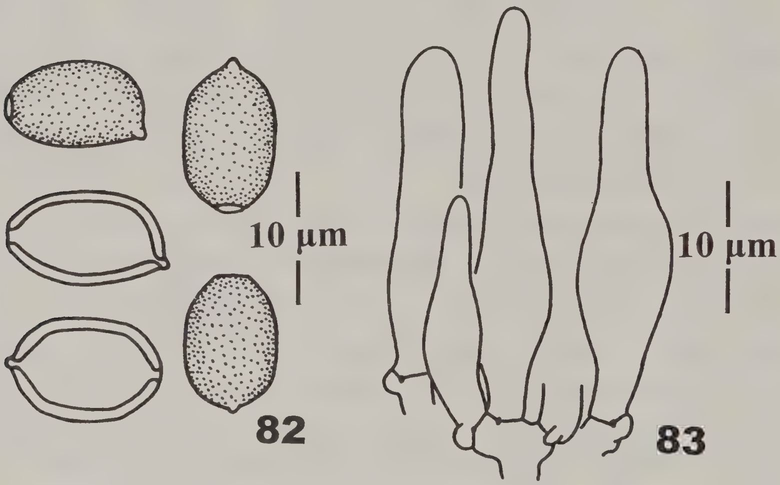
36. *Psathyra griseobadia* Pat., Bull. Soc. Mycol. France **8:** 47 (1892).

Pileus ca 3-6 mm in diam, convex; context very thin. Stipe 10-20 × 0.5-1.5 mm; base with white mycelium.

Spores [26/1/1] (9.0-)9.5-11.5 × 6.0-7.5 × 7.0-8.0 µm [Q_1 = 1.40-1.64(-1.89), $\mathbf{Q_1}$ = 1.55 ± 0.08; Q_2 = (1.27-)1.36-1.57, $\mathbf{Q_2}$ = 1.42 ± 0.08], ellipsoid in side view, sub-hexagonal in ventral view, fuscous-brown, thick-walled (less than 1 µm thick), with a truncate germ pore (Fig. 82). Basidia 22-27 × 8-11 µm, clavate, 4-spored. Cheilocystidia crowded, 15-30 × 5-7 µm, subclavate to fusiform to sublageniform, thin-walled, hyaline (Fig. 83). Pleurocystidia not seen. Pileipellis of repent, somewhat gelatinized, filamentous hyphae 2-5 µm wide, hyaline. Clamps common.

Specimen Examined: Ke So, Tonkin, Vietnam, Bon 4828 (Herb. Patouillard, FH 4423-holotype). On rotten debris [?].

Note: Due to the pileipellis of repent hyphae, the fuscous-brown spores with truncate germ pore, and sterile edge of lamellae, this taxon should be placed in *Psilocybe*. Therefore, a new combination is made here: ***Psilocybe griseobadia*** (Pat.) Z. L. Yang, **comb. nov.** [Basionym: *Psathyra griseobadia* Pat., Bull. Soc. Mycol. France **8:** 47 (1892)]. *Psilocybe griseobadia* can be arranged in the sect. *Coprophilae* Guzmán (1983), and is probably very close to the widely distributed *P. coprophila* (Bull.: Fr.) Kummer. However, the question is still open whether they are conspecific or not, because the pleurocystidia of *P. griseobadia*, if present, are unknown.



Figs. 82-83: *Psathyra griseobadia* (holotype).
82. Basidiospores; 83. Cheilocystidia.

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MYCOTAXON

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NOTES ON FUNGI FROM TAIWAN: TWO NEW NAMES

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ABSTRACT: Two new names, *Pseudocercospora pseudehretiae* and *Anthostomella taiwaniana*, are proposed to replace the later homonyms *P. ehretiae* (Togashi & Katsuki) C. Nakash. & Tak. Kobay. 1999 (*non* Goh & W.H. Hsieh, 1989) and *A. longispora* W.H. Hsieh, C.Y. Chen & Sivan. 1997 (*non* Dearn. & Barth, 1924), respectively, to comply with the International Code of Botanical Nomenclature.

KEYWORDS. Ascomycetes, mitosporic fungi, nomenclature, Taiwan

During the preparation of a checklist of fungi of Taiwan, we found at least two illegitimate binominals, *P. ehretiae* (Togashi & Katsuki) C. Nakash. & Tak. Kobay. (Nakashima *et al.*, 1999) and *Anthostomella longispora* W.H. Hsieh, C.Y. Chen & Sivan. (Hsieh *et al.*, 1997). Two new names are proposed here to correct these errors.

Pseudocercospora pseudehretiae Chao H. Chung & Tzean, ***nom. nov.***
Pseudocercospora ehretiae (Togashi & Katsuki) C. Nakash. & Tak. Kobay. in Nakashima, Nishijima & Kobayashi, Mycoscience 40: 271. 1999 (basionym *Cercospora ehretiae* Togashi & Katsuki, Botanical Magazine [Tokyo] 65: 20. 1952), *non Pseudocercospora ehretiae* Goh & W.H. Hsieh, Transactions of the Mycological Society of Republic of China 4(2): 117. 1989.

Recently, Nakashima *et al.* (1999) transferred six species of *Cercospora* described in Japan to the genus *Pseudocercospora*. One of them is *P. ehretiae* (Togashi & Katsuki) C. Nakash. & Tak. Kobay. (basionym *Cercospora ehretiae* Togashi & Katsuki, Botanical Magazine [Tokyo] 65: 20. 1952). The authors thought *P. ehretiae* Goh & W.H. Hsieh published previously was invalid because of lack of a Latin diagnosis. However, the circumstance is reversed: while Goh & Hsieh (1989), based on a modern taxonomic concept, transferred *Cercosporella ehretiae* Sawada (*nomen nudum*) (1959) to *Pseudocercospora*, they acturally provided it with a Latin diagnosis. Therefore, the epithet is valid and legitimate. Obviously, *Pseudocercospora ehretiae* (Togashi & Katsuki) C. Nakash. & Tak. Kobay. is a later homonym, violating Art. 53 of the International Code of Botanical Nomenclature (Greuter *et al.*, 1994). According to a detailed comparison of the three *Pseudocercospora* species on *Ehretia* made by Nakashima *et al.* (1999), we believe that *Cercospora ehretiae* Togashi & Katsuki is a distinct taxon, which can be easily separated from the correctly introduced *Pseudocercospora ehretiae* Goh & W.H. Hsieh.

Anthostomella taiwaniana Chao H. Chung & Tzean, ***nom. nov.***

Anthostomella longispora W.H. Hsieh, C.Y. Chen & Sivan., Mycological Research 101: 897. 1997, *non Anthostomella longispora* Dearn. & Barth. in Dearness, Mycologia 16: 157. 1924.

Hsieh *et al.* (1997) erected the binominal *Anthostomella longispora* to describe a new ascomycete in the Xylariales found on *Smilax* in Taiwan. Unfortunately, the epithet had already been introduced for an ascomycete from decorticated wood of *Populus sargentii* Dode in 1924 (Dearness, 1924). Obviously, the epithet is an illegitimate, later homonym. Therefore, a new name *Anthostomella taiwaniana* is introduced.

We thank Dr. Walter Gams (Centraalbureau voor Schimmelcultures, the Netherlands) for presubmitting review and valuable comments.

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MYCOTAXON

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NON-LICHENIZED FUNGAL TAXA DESCRIBED FROM SLOVAKIA. Part 1

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ABSTRACT: Names of fungal taxa described from Slovakia are listed. An iconotype and an epitype for *Agaricus atramentosus* and lectotypes for *Humaria sabranskyana*, *Peltidium oocardii* and *Peziza bulgarioides* are designated, and the new combinations *Peziza adae* var. *latispora* (for *Galactinia adae* f. *latispora)* and *Clitocybe gibba* f. *adstrigens* (for *Clitocybe gibba* var. *adstrigens)* are proposed.

KEYWORDS: Ascomycota, Basidiomycota, new taxa, taxonomic status

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While compiling the checklist of Slovak fungi (P. Lizoň & K. Bacigálová (eds.), *Huby/Fungi.* In: K. Marhold & F. Hindák (eds.), *Zoznam nižších a vyšších rastlín Slovenska/Checklist of non-vascular and vascular plants of Slovakia,* 1998) the identity of numerous names proposed for fungi described from Slovakia was not recognized. The following list addresses the problem by providing the current taxonomic and nomenclatural status of included taxa and, when available, where the type specimen is housed. This should provoke specialists to study these fungi and approve or correct the taxonomic status presented here.

Each entry has the original name, author and place of valid publication, collection site, information on type specimen, and accepted name. Collection sites are cited the same way as they were originally published. Accepted names or names in current use are boldfaced. Bracketed inserts include current geographical and administrative names of collection sites, and/or explanatory notes.

For authorities of taxa standard abbreviations in *Authors of Plant Names* (R. K. Brummit & C. E. Powell, 1992) and for herbaria and collection acronyms in

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Index Herbariorum (P. K. Holmgren & al., eds., 1990) were followed. Standard abbreviations and forms for journal and book titles are used as listed in *Botanico-Periodico-Huntianum* (G. H. M. Lawrence & al., eds., 1968), *Botanico-Periodico-Huntianum/ Supplementum* (G. D. R. Bridson, ed., 1991), and in *Taxonomic Literature* (2nd ed., F. A. Stafleu & R. Cowan, vol. 1–7, 1976–1988, and F. A. Stafleu & E. A. Mennenga, Supplements, vol. 1–4, 1992–1997).

ASCOMYCOTA

Balsamia fusispora Schulzer (Verh. Zool.-Bot. Ges. Wien 20: 174-175, 1870)
[Eastern Slovakia, Blažovská dolina valley near the city of Prešov.][2]
Listed and noted as dubious by Saccardo (Syll. Fung. 10: 80, 1892).

Belonidium lizonii Svrček (Česká Mykol. 42: 139, 1988)
"Slovacia occidentalis: Bratislava, in horto privato dom. Dr. Pavel Lizoň, 230 m s. m., VI. 1987, leg. P. Lizoň." Holotype in PRM.
≡ ***Trichopeziza lizonii*** (Svrček) Baral & E. Weber ([Bibl. Mycol. 120] in Weber, Untersuchungen zu Fortpflanzung und Ploidie verschiedener Ascomyceten, p. 105, 1992).

Chlorosplenium hyperici-maculati Svrček (Česká Mykol. 46: 34, 1992)
"Slovakia: ad caules emortuos deiectos Hyperici maculati, montes Belianske Tatry, Tatranská Kotlina, in convalle Kotlina siedmich prameňov (= Holubyho dolina), in declivitate montis Bujačí vrch (1950 m s. m.), loco Lavinový žlab, 1900 m s. m., 5. X.1958, leg. J. Kubička et M. Svrček." Holotype in PRM.

Crouania laucifera Hazsl. (Math. Természettud. Közlem. 21: 262, 1886)
"...földön. S.-A.-Újhely környékéböl [environs of the town of Slovenské Nové Mesto] küldte Chyser vagy Dietz." Neither type nor original material have been located. As noted by Svrček (Česká Mykol. 35: 134, 1981) this is a member of the genus ***Scutellinia.***

Dasyscyphus lundellii Le Gal ex Svrček (Česká Mykol. 16: 112, 1962)
"ČSSR: Slovakia, montes Nízke Tatry, in valle Trangoška dicto, cca 1200-1500 m s. m.. 8.IX.1960 (leg. F. Kotlaba)." Holotype in PRM.
= ***Dasyscyphella dryina*** (P. Karst.) Raitv. (Scripta Mycol. 1: 72, 1970)

Eriopezia roseolo-tincta Svrček (Česká Mykol. 12: 226-227, 1958)
"Slovakia septentr., montes Belanské Tatry, in convalle 'Holubyho dolina' dicta, in caulibus et foliis emortuis Luzulae albidae = L. nemorosae, loco unico frequens, 3.VIII.1956, cca 1500 m s. m. (J. Kubička et M. Svrček leg.)." Holotype in PRM.

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[2] Stephan Schulzer has not given details on collections sites of his field trip to Blažovská dolina valley. Because no specimens are available and descriptions are vague, all his taxa erected in his paper Mykologische Beobachtungen aus Nord-Ungarn im Herbste 1869 (Schulzer, Verh. Zool.-Bot. Ges. Wien 20: 69-210, 1870) are treated as dubious here.

Korf (Mycotaxon 7: 484, 1978) while studying the type specimen has found out that ascocarps, immersed in a subiculum, are not apothecia but hypocreaceous perithecia. He identified the fungus as a pyrenomycete *Nectriella carnea* (Desm.) Sacc. [= ***Pronectria robergei*** (Mont. & Desm.) Lowen].

Galactinia adae (J. Sadler) Boud. f. *latispora* J. Moravec (Česká Mykol. 23: 32, 1969)
"Ad terram humidam nudam, ad destructionis calicatum, Slovakia, Lysá Poľana, 19.IX.1967." Holotype in PRM.
≡ ***Peziza adae*** (J. Sadler) Boud. **var. *latispora*** (J. Moravec) Lizoň, comb. n.
Basionym: *Galactinia adae* (J. Sadler) Boud. f. *latispora* J. Moravec, Česká Mykol. 23: 32, 1969.

Galactinia praetervisa (Bres.) Boud. var. *minor* J. Moravec (Česká Mykol. 23: 32, 1969)
"In carbonariis in picetis, Slovakia, Belanské Tatry prope Ždiar, 16.IX.1967." Holotype in PRM.
= ***Peziza subviolacea*** Svrček [fide Svrček, Česká Mykol. 35: 71, 1981]

Helotium dumbirense Velen. (Monogr. Discom. Boh. 1: 188, 1934)
"In lignis frondosis in aqua immersis in m. Tatra (Ďumbir) [Mt. Ďumbier, Nízke Tatry Mts.] aug. 1930 leg. Cae. Cejp." Holotype in PRM.
≡ ***Ciboria dumbiresis*** (Velen.) Spooner (Trans. Brit. Mycol. Soc. 91: 517, 1988)
Svrček (Česká Mykol. 46: 162, 1992) erected a monotypic genus *Tatrea* for this species.

Helotium geiphilum Velen. (Monogr. Discom. Boh. 1: 193, 1934)
"Ad rhizoma Gei rivalis m. Tatra (1800 m) supra Lomnice [village of Tatranská Lomnica, Vysoké Tatry Mts.] 1924, 7 leg. Pilát." Holotype in PRM.
Svrček (Sbor. Nár. Muz. Praha 40B[1984]: 150, 1985) noted that the species is probably conspecific with ***Hymenoscyphus vitellinus*** (Rehm) Kuntze.

Helotium pallidae-subolivaceum Svrček (Česká Mykol. 12: 228, 1958)
"Slovakia septentr., montes Belanské Tatry, in convalle 'Holubyho dolina' dicta, ad acus putr. Abietis albae, Piceae excelsae, ad ramum putr. Piceae exc., ad folia putr. Vaccinii myrtillii et vitis-idaeae, in silva humida, sphagnetosa, ... 19.V.1958, cca 1100 m s. m. (J. Kubička et M. Svrček leg.)." Holotype in PRM.
≡ ***Hymenoscyphus pallidae-subolivaceus*** (Svrček) Lizoň (Mycotaxon 44: 321, 1992).

Helotium repandum W. Phillips f. *citripes* Svrček (Česká Mykol. 16: 113, 1962)
"CSSR: Slovakia, montes Nízke Tatry, in valle rivi 'Bystrý potok' prope Trangoška, cca 1150 m s. m., 6.IX.1960 (leg. J. Kubička.)." Holotype in PRM.
≡ ***Hymenoscyphus repandus*** (W. Phillips) Dennis **f. *repandus*** [fide Lizoň, Mycotaxon 44: 37, 1992]

Helotium rokeybense Svrček (Česká Mykol. 16: 113, 1962)
"ČSSR: Slovakia, montes Nízke Tatry, in valle rivi 'Bystrý potok' prope Trangoška, cca 1150 m s. m., 5.-6.IX.1960 (leg. M. Mates et M. Svrček)." Holotype in PRM.
≡ ***Hymenoscyphus rokebyensis*** (Svrček) Matheis (Mitt. Thurgauischen Naturf. Ges. 43: 157, 1979)

Helotium tatrae Svrček (Česká Mykol. 12: 228, 1958)
"Slovakia septentr., montes Belanské Tatry, in convalle 'Holubyho dolina' dicta, ad acus putr. Laricis deciduae subsp. polonicae et rare etiam (ap. unicum) ad folium putr. udum Caricis glaucae subsp. claviciformis, 19. et 22.V.1958, cca 1250 m s. m. (J. Kubička et M. Svrček leg.)." Holotype in PRM.
≡ ***Hymenoscyphus tatrae*** (Svrček) Lizoň (Mycotaxon 44: 322, 1992)

Helvella tremelloides Schulzer (Verh. Zool.-Bot. Ges. Wien 20: 174, 1870)
≡ *Helvella lacunosa* Afzel. b *tremelloides* (Schulzer) Hazsl. (Ért. Term.-Tud. Kör. 11(19): 13, 18810
[Eastern Slovakia, Blažovská dolina valley near the city of Prešov.]
Lizoň (Thaiszia 7: 56, 1997) synonymized, according to the original desciption, the species with ***Helvella lacunosa*** Afz. Saccardo (Syll. Fung. 22: 600, 1913) listed the species as a synonym (with a question mark) of *H. tremellosa* Krombh. [= *Gyromitra gigas* (Krombh.) Quél].

Humaria sabranskyana Bäumler (Verh. Ver. Natur- Heikde. Pressburg 9: 162, 1897)
"Gemsenberg auf der Erde unter Thuidium am Wegw, da Spathularia flavida und Pirola steht, August 1891." Syntype: Krypt. Exsic. Mus. Palat. Vindob.,no. 2632. Lectotype in FH (designated here), lectoisotype in PRM.
Svrček (Česká Mykol. 35: 135, 1981) found out that the specimen has inoperculate asci and the species is probably a member of the genus ***Pachydisca.***

Hymenoscyphus caeruleo-maculatus Svrček (Česká Mykol. 46: 35, 1992)
"Slovacia: Herľany, silva parkensis, 25. IX. 1990, leg. H. Deckerová." Holotype in PRM.

Hymenoscyphus ombrophilaeformis Svrček (Česká Mykol. 31:11, 1977)
"Bohemoslovakia, Slovakia, in montibus Strážovské vrchy, Pružina, in valle rivi Dobovsek ad pedem montis Strážov (1213 m s. m.), ca 800 m s. m., 22.IX.1975." Holotype in PRM.

Kubickia tatrensis Svrček (Česká Mykol. 11: 38, 1957)
"Slovakia, montes Vysoké Tatry: lacus “Trojhranné pleso” dictus haud procul 'Kežmarská chata' prope Tatranská Lomnica, in sphagneto ad marginem septentrionalem et inter septentriones et orientem solem, 1614 m supra mare, 10.VIII.1055 leg. MUDR. Georgius Kubička" Holotype in PRM.
Originally proposed as *Kubičkia tatrensis.*

Lachnum belaense Svrček (Česká Mykol. 12: 228, 1958)
"Slovakia septentr., montes Belanské Tatry, in convalle 'Holubyho dolina' dicta,ad truncos et ramos decorticatos in rivulo iacentes Aceris pseudoplatani, 22.V.1958, cca 1250 m s. m. (M. Svrček leg.)." Holotype in PRM.

Lachnum pseudocorticale Svrček (Česká Mykol. 12: 229, 1958)
"Slovakia septentr., montes Belanské Tatry, in convalle 'Holubyho dolina' dicta, ad ramos decorticatos (in ligno duro) Piceae excelsae, in aqua rivuli immersos, sed etiam extra aquam locis humidis, frequens, 22. V. 1958, cca 1250 m s. m. (Z. Borovanská, J. Kubička et M. Svrček leg.)." Holotype in PRM.

Lamprospora georgii Svrček (Česká Mykol. 12: 229, 1958)
"Czechoslovakia: Slovacia, Mt. Belanské Tatry, Ždiar, ad ripa rivuli Belá, sub Petasites sp. ad terram humidam nudam arenosam, 16.IX.1967." Neotype in BRA, isoneotype in CUP. Neotypified by J. Moravec since Svrček's holotype (Slovakia septentr., montes Belanské Tatry, ad terra humidam nudam in Petasiteto, 1.VIII.1956, cca 1200 m s. m. J. Kubička leg.) has been missing in PRM.
≡ ***Marcelleina georgii*** (Svrček) J. Moravec (Mycotaxon 30: 482, 1987)

Miyoshiella larvata Réblová (Mycotaxon 71:28, 1999)
"Slovakia orientalis, Mt. Rudník, in ligno putrido Abietis albae, 17 Aug 1972, leg. V. Holubová-Jechová." Holotype in PRM.

Nectria tatrensis Alstrup (Biologia, Bratislava, 51: 13, 1966)
"Slovakia, Tatra National Park, Tatranská Kotlina, Suchá dolina, alt. 850 m, on Thelidium fumidum (Nyl.) Hazsl., 24. Sept. 1993, V. Alstrup." Holotype in C.

Nummularia dennisii Pouzar (Kew Bull. 31: 653, 1977)
"Czechoslovakia: on a fallen branch of Acer campestris in a forest pathway in bottomland forest on the bank of river Hron, 130 m alt., 0.5 km west of 'Jarok' gamekeeper lodge near Želiezovce (distr.of Levice), southern Slovakia, 19. Oct. 1972, Pouzar." Holotype in PRM, isotype in K.
≡ ***Biscogniauxia dennisii*** (Pouzar) Pouzar (Česká Mykol. 33: 216, 1979)

Patinella dryadea Velen. (Monogr. Discom. Boh. 1: 75, 1934)
"Ad caules vetustos Dryadis octopetalae in m. Tatra [Vysoké Tatry Mts.] aug. 1926, leg. Alb. Pilát." Holotype in PRM.
As noted by Chlebicki (Acta Bot. Polon. 64: 396, 1995) this is probably a member of the genus ***Lecidiella*** sp. (Lichenes).

Peltidium oocardii Kalchbr. (Hedwigia 2: 58, 1862)
"Hab. rarissime ad lapides submersos et Oocardo strato (Naeg.) incrustatos, in torrende vallis Bösenstein ad Olaszinum [place called Pod skalou now, E from the village of Spišské Vlachy] (Wallendorf, Centralcarpathen). Sero autumno et ine. unte hyene." Syntype: Rabenhorst, Fungi Eur. exs., no. 521. Lectotype in BRA (designated here), lectoisotypes in CUP, FH, BPI.
= ***Pachyella babingtonii*** (Berk. & Broome) Boud. [fide Pfister, Can. J. Bot. 51: 2013, 1973]

Peziza bulgarioides Rabenh. (in Kalchbrenner, Math. Term.-Tud. Közlem. 7: 269, pl. 3/4, 1868)
"Fenyö tobozokon. A Stolcsek hegyen, Szepes-Váralja közelében [hill Stolček, close to the town of Spišské Podhradie]." Syntype: Rabenhorst, Fungi europaei exsic. no. 1311; lectotype in PRM (designated here), lectoisotype in CUP.
≡ ***Piceomphale bulgarioides*** (Rabenh.) Svrček (Česká Mykol. 11: 240, 1957)

Pulvinula haemastigma (Hedw.) Boud. **var.** ***luteoflava*** J. Moravec (Česká Mykol. 23: 25, 1969)
"Ad terram humidam nudam vel muscosam ad rivum 'Belá' (montes Belanské Tatry) prope Ždiar, Slovakia, 19. IX. 1967." Holotype at PRM.

Pustularia riparia Hazsl. (Math. Természettud. Közlem. 21: 270, 1886)
"meredek agyagospatakparton. Sz.-Olaszi környékeen [environs of the village Spišské Vlachy], hol Klch. szedte." Neither type nor original material have been located. Accepted by Saccardo (Syll. Fung. 8: 93, 1889). Svrcek (Česká Mykol. 35: 137, 1981) noted that the species might represent ***Peziza michelii*** (Boud.) Dennis.

Sowerbyella densireticulata J. Moravec (Mycotaxon 23: 493, 1985)
"Slovacia bor.: montes Vysoké Tatry prope Východná et Važec, 850 m, ad marginem silvae coniferarum in aciculis, 3.IX.1972, leg. Ing. Jan Kuthan" Holotype in BRA, isotype in CUP.

Therrya pini (Alb. & Schwein.) Höhn. **var.** ***mughicola*** Svrček (Česká Mykol. 12: 230, 1958)
"Slovakia septentr., montes Belanské Tatry, in convalle "Holubyho dolina" dicta, ad ramos emortuos Pini mugho, 3.-4.VIII.1956, cca 1500-1600 m s. m. (J. Kubička et M. Svrček leg.)." Holotype in PRM.

Trichoscyphella carpatica Svrček (Česká Mykol. 16:; 113, 1962)
"ČSSR: Slovakia, montes Nízke Tatry, in valle rivi "Bystrý potok" prope Trangoška, cca 1150 m s. m., 6.IX.1960 (leg. T. Piane)." Holotype in PRM.

[Valsaria fraxini Hazsl. (in Herb. Nits.)]
This is a nomen nudum which Wehmeyer (Trans. Brit. Mycol. Soc. 12: 269, 1933) has probably seen in the T. R. J. Nitschke's collection in B and later listed within the synonymy of ***Diaporthe pustulata*** (Desmaz.) Sacc.

BASIDIOMYCOTA

Agaricus asininus Kalchbr. (in Fries, Hymenom. Eur., p. 230, 1874)
"Sub Pinu silvestri in luco prope Olaszinum [village of Spišské Vlachy]."
Accepted by Saccardo (Syll. Fung. 5: 771, 1887) as *Inocybe asinina* (Kalchbr.) Sacc. Type or original material has not been located.
Kuyper (Persoonia, suppl. 3: 221, 1986) noted, referring to the Kalchbrenner's picture (Icon. sel. Hymenom. Hung. 3: pl. 22/1, 1875), that this is probably not an *Inocybe.*

Agaricus asterospermus Schulzer (Verh. Zool.-Bot. Ges. Wien 20: 195, 1870)
[Eastern Slovakia, Blažovská dolina valley near the city of Prešov.]
Dubious.

Agaricus atramentosus Kalchbr. (Icon. Select. Hymenom. Hung. 1:15, pl. 6/2, 1873)
"Ad truncos putridos pinuum Scepusii [region of Spiš], parce. Aug." Type or original material not located. Iconotype (designated here): Kalchbrenner, l. c.; epitype (designated here): Slovakia, Dobročský prales ve Slov. rudohoří, Abies, 29.VIII.1961, leg. F,. Kotlaba & Z. Pouzar (PRM).
≡ ***Hydropus atramentosus*** (Kalchbr.) Kotl. & Pouzar (Česká Mykol. 16: 182, 1962)

Agaricus augusti Schulzer (Verh. Zool.-Bot. Ges. Wien 20: 193, 1870)
[East Slovakia, Blažovská dolina valley near the city of Prešov.]
Dubious.

Agaricus aureola Kalchbr. (Icon. Select. Hymenom. Hung. 1: 9, pl. 1/1, 1873)
"Scepusii, in montium Olasziensium [mountains near the village of Spišské Vlachy] summo iugo, locis graminosis, umbrosis, muscosis, inter fagos et abies rarossime. Exeunte Augusto." Neither type nor original material have been located.
≡ ***Amanita muscaria*** (L.) Pers. **f.** ***aureola*** (Kalchbr.) Veselý (Ann. Mycol. 32: 253, 1933)

Agaricus baloghi Schulzer (Verh. Zool.-Bot. Ges. Wien 20: 205-206, 1870)
[Eastern Slovakia, Blažovská dolina valley near the city of Prešov.]
Dubious.

Agaricus carpathicus Kalchbr. b *pileo-levi* Schulzer (Verh. Zool.-Bot. Ges. Wien 20: 200, 1870)
[Eastern Slovakia, Blažovská dolina valley near the city of Prešov.]
Dubious.

Agaricus centurio Kalchbr. (Icon. Select. Hymenom. Hung. 1: 13, pl. 4/2, 1873)
"In pinetis muscosis, circa Olaszinum [near the village of Spišské Vlachy] raro. Sept. Oct." Accepted by Saccardo (Syll. Fung. 5: 97, 1887) as *Tricholoma centurio* (Kalchbr.) Sacc. Neither type nor original material have been located.
= ***Lyophyllum transforme*** (Fr.) Kühn. [fide Riva, Tricholoma, p. 34, 1988]

Agaricus columbetta Fr. b *glaber* Schulzer (Verh. Zool.-Bot. Ges. Wien 20: 206, 1870)
[Eastern Slovakia, Blažovská dolina valley near the city of Prešov.]
Dubious.

Agaricus czengeryi Schulzer (Verh. Zool.-Bot. Ges. Wien 20: 205, 1870)
[Eastern Slovakia, Blažovská dolina valley near the city of Prešov.]
Dubious.

Agaricus dictyotus Kalchbr. (Icon. Select. Hymenom. Hung. 4: 63, pl. 32/4, 1877)
"In pascuis collis Werpusch, prope Olaszinum. [near the village of Spišské Vlachy] Rarus." Neither type nor original material have been located.
This is probably a synonym of *Galera pygmeoaffinis* Fr. [≡ ***Conocybe pygmeoaffinis*** (Fr.) Kühner] as noted by Quélet (Enchir. Fung., p. 106, 1886).

Agaricus divaldi Schulzer (Verh. Zool.-Bot. Ges. Wien 20: 190, 1970)
[East Slovakia, Blažovská dolina valley near the city of Prešov.]
Dubious.

Agaricus dolinensis Schulzer (Verh. Zool.-Bot. Ges. Wien 20: 200, 1870)
[East Slovakia, Blažovská dolina valley near the city of Prešov.]
Dubious.

Agaricus dukai Schulzer (Verh. Zool.-Bot. Ges. Wien 20: 202, 1870)
[East Slovakia, Blažovská dolina valley near the city of Prešov.]
Dubious.

Agaricus dulcamarus Pers. b [no name] Schulzer (Verh. Zool.-Bot. Ges. Wien 20: 194, 1870)
[East Slovakia, Blažovská dolina valley near the city of Prešov.]
Dubious.

Agaricus dulcissimus Schulzer (Verh. Zool.-Bot. Ges. Wien 20: 205, 1870)
[East Slovakia, Blažovská dolina valley near the city of Prešov.]
Dubious.

Agaricus edmundi Schulzer (Verh. Zool.-Bot. Ges. Wien 20: 197, 1870)
[East Slovakia, Blažovská dolina valley near the city of Prešov.]
Dubious.

Agaricus fastibilis Pers. b *subumbonatus* Schulzer (Verh. Zool.-Bot. Ges. Wien 20: 192, 1870)
[East Slovakia, Blažovská dolina valley near the city of Prešov.]
Dubious.

Agaricus fimetosus Schulzer (Verh. Zool.-Bot. Ges. Wien 20: 186, 1870)
[East Slovakia, Blažovská dolina valley near the city of Prešov.]
Dubious.

Agaricus flavidulus Schulzer (Verh. Zool.-Bot. Ges. Wien 20: 189, 1870)
[East Slovakia, Blažovská dolina valley near the city of Prešov.]
Dubious.

Agaricus fodiens Kalchbr. (Icon. Select. Hymenom. Hung. 4: 62, pl. 36/2, 1877)
"Locis apricis silvarum, Olasziensium [village of Spišské Vlachy], ad basim truncorum Pini." Antonín and Noordellos (Mycotaxon 63: 365, 1997) designated a neotype (Sweden. Småland; in IB) because neither type nor original material have been located.

≡ ***Rhodocollybia fodiens*** (Kalchbr.) Antonín & Noordel. (l. c.)

Agaricus fragilissimus Schulzer (Verh. Zool.-Bot. Ges. Wien 20: 187, 1870)
[East Slovakia, Blažovská dolina valley near the city of Prešov.]
Dubious.

Agaricus frauenfeldii Schulzer (Verh. Zool.-Bot. Ges. Wien 20: 197)
[East Slovakia, Blažovská dolina valley near the city of Prešov.]
Dubious.

Agaricus frivaldszkyi Schulzer (Verh. Zool.-Bot. Ges. Wien 20: 209, 1870)
[East Slovakia, Blažovská dolina valley near the city of Prešov.]
Dubious.

Agaricus goenczyi Schulzer (Verh. Zool.-Bot. Ges. Wien 20: 204, 1870)
[East Slovakia, Blažovská dolina valley near the city of Prešov.]
Dubious.

Agaricus gracilis Pers.b *minimus* Schulzer (Verh. Zool.-Bot. Ges. Wien 20: 186, 1870)
[East Slovakia, Blažovská dolina valley near the city of Prešov.]
Dubious.

Agaricus gyulaii Schulzer (Verh. Zool.-Bot. Ges. Wien 20: 191, 1870)
[East Slovakia, Blažovská dolina valley near the city of Prešov.]
Dubious.

Agaricus hantkeni Schulzer (Verh. Zool.-Bot. Ges. Wien 20: 198, 1870)
[East Slovakia, Blažovská dolina valley near the city of Prešov.]
Dubious.

Agaricus haynaldii Schulzer (Verh. Zool.-Bot. Ges. Wien 20: 196, 1870)
[East Slovakia, Blažovská dolina valley near the city of Prešov.]
Dubious.

Agaricus henszelmanni Schulzer (Verh. Zool.-Bot. Ges. Wien 20: 201, 1870)
[East Slovakia, Blažovská dolina valley near the city of Prešov.]
Dubious.

Agaricus horvathi Schulzer (Verh. Zool.-Bot. Ges. Wien 20: 201, 1870)
[East Slovakia, Blažovská dolina valley near the city of Prešov.]
Dubious.

Agaricus hunfalvyi Schulzer (Verh. Zool.-Bot. Ges. Wien 20: 208, 1870)
[East Slovakia, Blažovská dolina valley near the city of Prešov.]
Dubious.

Agaricus jedliki Schulzer (Verh. Zool.-Bot. Ges. Wien 20: 198, 1870)
[East Slovakia, Blažovská dolina valley near the city of Prešov.]

Dubious.

Agaricus jendrassiki Schulzer (Verh. Zool.-Bot. Ges. Wien 20: 207, 1870)
[East Slovakia, Blažovská dolina valley near the city of Prešov.]
Dubious.

Agaricus josephi Schulzer (Verh. Zool.-Bot. Ges. Wien 20: 208, 1870)
[East Slovakia, Blažovská dolina valley near the city of Prešov.]
Dubious.

Agaricus kalchbrenneri Schulzer (Verh. Zool.-Bot. Ges. Wien 20: 190, 1870)
[East Slovakia, Blažovská dolina valley near the city of Prešov.]
Dubious.

Agaricus kyinyi Schulzer (Verh. Zool.-Bot. Ges. Wien 20: 202, 1870)
[East Slovakia, Blažovská dolina valley near the city of Prešov.]
Dubious.

Agaricus lacerus Fr. b *argillophyllus* Schulzer (Verh. Zool.-Bot. Ges. Wien 20: 190, 1870)
[East Slovakia, Blažovská dolina valley near the city of Prešov.]
Dubious.

Agaricus longicaudis Pers. b *albus* Schulzer (Verh. Zool.-Bot. Ges. Wien 20: 193, 1870)
[East Slovakia, Blažovská dolina valley near the city of Prešov.]
Dubious.

Agaricus lonyayi Schulzer (Verh. Zool.-Bot. Ges. Wien 20: 191, 1870)
[East Slovakia, Blažovská dolina valley near the city of Prešov.]
Dubious.

Agaricus margoi Schulzer (Verh. Zool.-Bot. Ges. Wien 20: 199, 1870)
[East Slovakia, Blažovská dolina valley near the city of Prešov.]
Dubious.

Agaricus mernszenii Schulzer (Verh. Zool.-Bot. Ges. Wien 20: 186, 1870)
[East Slovakia, Blažovská dolina valley near the city of Prešov.]
Dubious.

Agaricus mikoi Schulzer (Verh. Zool.-Bot. Ges. Wien 20: 187, 1870)
[East Slovakia, Blažovská dolina valley near the city of Prešov.]
Dubious.

Agaricus nefrens Fr. b *extrius* Schulzer (Verh. Zool.-Bot. Ges. Wien 20: 197, 1870)
[East Slovakia, Blažovská dolina valley near the city of Prešov.]
Dubious.

Agaricus nendtvichi Schulzer (Verh. Zool.-Bot. Ges. Wien 20: 202, 1870)
[East Slovakia, Blažovská dolina valley near the city of Prešov.]
Dubious.

Agaricus nympharum Kalchbr. (Icon. Select. Hymenom. Hung. 1: 10, pl. 2/1, 1873)
"Scepusii in lucis fertilibus, campestribus, graminosis, inter pinus sparsas et ad margines silvarum, prope Olaszinum [near the village of Spišské Vlachy], quibusdam annis copiose. Aug." Neither type nor original material have been located.
Accepted by Saccardo (Syll. Fung. 5: 42, 1887) as *Lepiota nympharum* (Kalchbr.) Sacc. and treated as *Macrolepiota nympharum* (Kalchbr.) Wasser by Wasser (Agarikovyje griby SSSR, p. 114, 1985).
= ***Macrolepiota puellaris*** (Fr.) M. M. Moser [fide Candusso & Lanzoni, Lepiota, p. 525, 1990]

Agaricus pelta Schulzer (Verh. Zool.-Bot. Ges. Wien 20: 209, 1870)
[East Slovakia, Blažovská dolina valley near the city of Prešov.]
Dubious.

Agaricus pettkoi Schulzer (Verh. Zool.-Bot. Ges. Wien 20: 202, 1870)
[East Slovakia, Blažovská dolina valley near the city of Prešov.]
Dubious.

Agaricus plebejus Kalchbr. (Icon. Select. Hymenom. Hung. 2: 22, pl. 12/1, 1874)
"In pratis pascuisve, circa Olaszinum [village of Spišské Vlachy]. Vernalis, sed etiam sero autumno lectus, in numerosis saepe gregibus." Neither type nor original material have been located.
≡ ***Entoloma plebejum*** (Kalchbr.) Noordel. (Persoonia 12: 462, 1985)

Agaricus polyai Schulzer (Verh. Zool.-Bot. Ges. Wien 20: 201, 1870)
[East Slovakia, Blažovská dolina valley near the city of Prešov.]
Dubious.

Agaricus psammopus Kalchbr. (Icon. Select. Hymenom. Hung. 1: 12, pl. 3/2, 1873)
"In pinetis montanis siccioribus, praesertim sub laricibus, ad Balázsvölgy [valley Blažovská dolina near the city of Prešov] comitatus Sarosiensis (Schulzer) et ad Olaszinum [village of SpišskéVlachy] Scepusii, raro. Aug. Sept." Neither type nor original material have been located.
≡ ***Tricholoma psammopus*** (Kalchbr.) Quél. (Mém. Soc. Emul. Montbéliard, ser. 2, 5: 433, 1875)

Agaricus pulszkyi Schulzer (Verh. Zool.-Bot. Ges. Wien 20: 195, 1870)
[East Slovakia, Blažovská dolina valley near the city of Prešov.]
Dubious.

Agaricus purus Pers. b *obtusus* Schulzer (Verh. Zool.-Bot. Ges. Wien 20: 200, 1870)
[East Slovakia, Blažovská dolina valley near the city of Prešov.]
Dubious.

Agaricus quinquepartitus L. b *inconstans* Schulzer (Verh. Zool.-Bot. Ges. Wien 20: 206, 1870)
[East Slovakia, Blažovská dolina valley near the city of Prešov.]
Dubious.

Agaricus romeri Schulzer (Verh. Zool.-Bot. Ges. Wien 20: 189-190, 1870)
[East Slovakia, Blažovská dolina valley near the city of Prešov.]
Dubious.

Agaricus schenzli Schulzer (Verh. Zool.-Bot. Ges. Wien 20: 204, 1870)
[East Slovakia, Blažovská dolina valley near the city of Prešov.]
Dubious.

Agaricus segestrellus Fr. b *subumbonatus* Schulzer (Verh. Zool.-Bot. Ges. Wien 20: 191, 1870)
[East Slovakia, Blažovská dolina valley near the city of Prešov.]
Dubious.

Agaricus striatipes Schulzer (Verh. Zool.-Bot. Ges. Wien 20: 204, 1870)
[East Slovakia, Blažovská dolina valley near the city of Prešov.]
Dubious.

Agaricus subpulverulentus Pers. b *subumbonatus* Schulzer (Verh. Zool.-Bot. Ges. Wien 20: 207, 1870)
[East Slovakia, Blažovská dolina valley near the city of Prešov.]
Dubious.

Agaricus supinus Fr. b *subcarnosus* Schulzer (Verh. Zool.-Bot. Ges. Wien 20: 199, 1870)
[East Slovakia, Blažovská dolina valley near the city of Prešov.]
Dubious.

Agaricus szaboi Schulzer (Verh. Zool.-Bot. Ges. Wien 20: 188, 1870)
[East Slovakia, Blažovská dolina valley near the city of Prešov.]
Dubious.

Agaricus sztocseki Schulzer (Verh. Zool.-Bot. Ges. Wien 20: 193, 1870)
[East Slovakia, Blažovská dolina valley near the city of Prešov.]
Dubious.

Agaricus thani Schulzer (Verh. Zool.-Bot. Ges. Wien 20: 186, 1870)
[East Slovakia, Blažovská dolina valley near the city of Prešov.]
Dubious.

Agaricus toldyi Schulzer (Verh. Zool.-Bot. Ges. Wien 20: 190, 1870)
[East Slovakia, Blažovská dolina valley near the city of Prešov.]
Dubious.

Agaricus tuberculatus Schulzer (Verh. Zool.-Bot. Ges. Wien 20: 203, 1870)
[East Slovakia, Blažovská dolina valley near the city of Prešov.]

Dubious.

Agaricus typhae Kalchbr. (in Rabenhorst. Fungi Eur. 306, 1861)
"In foliis putrescentibus Typhae latifoliae, ino et in vaginius scoporum ejusdem. laetevegetantium, per paludes ad Hernadum fluvium (Scepusii) prope Olaszinum [village of Spišské Vlachy]. Julio 1860. leg. Kalchbrenner" Isotype: Rabenhorst. Fungi Eur. 306 [CUP specimen is poor - two compressed fruitbodies].
≡ ***Psathyrella typhae*** (Kalchbr.) Pears. & Dennis (Trans. Brit. Mycol. Soc. 31: 185, 1948)

Agaricus vulpecula Kalchbr. (in Fries, Hymenom. Europ., p. 83, 1874)
"In pinetis elatioribus, per montes Olasziensium [village of Spišské Vlachy], in terra. Sept. Oct." Neither type nor original material have been located.
= *Clitocybe amara* Alb. & Schwein. [fide Bresadola. Icon. Mycol. 1: 138, 1927] = ***Leucopaxillus gentianeus*** (Quél.) Kotl.

Agaricus zigmondyi Schulzer (Verh. Zool.-Bot. Ges. Wien 20: 192, 1870)
[East Slovakia, Blažovská dolina valley near the city of Prešov.]
Dubious.

Amanita vaginata (Bull.) Lam. **f. *olivaceoviridis*** Fábry (Čas. Českoslov. Houb. 48: 46, 1971)
"...Zoltán Novák...15.IX.1970 in fagetis prope Biely Kríž [place in Malé Karpaty Mts. near to the city of Bratislava] (Slovacia) legit." Holotype in BRA.
Wasser (Fl. Gribov Ukrainy, Bazidiomicety, Amanitalnyje griby, p. 141, 1992) transfered this variety to *Amanitopsis,* a genus which is not generaly accepted by current authors, as *Amanitopsis vaginata* (Bull.) Roze var. *olivaceoviridis* (Fábry) Wasser.

Boletus depressus Schulzer (Verh. Zool.-Bot. Ges. Wien 20: 177, 1870)
[East Slovakia, Blažovská dolina valley near the city of Prešov.]
Dubious.

Boletus edulis Bull. **var. *arenarius*** Engel, Krieglsteiner & Dermek (in Engel & al., Dickröhlinge, p. 45, pl. 6, 1983)
"[village of] Studienka (Slovacia occidentalis, ČSSR), sub Pino sylvestri, solo arenoso, 16. IX. 1978." Holotype in BRA.

Boletus erythropus Pers. **var. *rubropileus*** Dermek (Fung. Rar. Icon. Color. 13: 10-11, pl. 103, 1984)
"[village of] Jabloňovce (Central Slovakia) under Quercus, coll. Z. Novák and M. Zápařka, 7 July 1979." Holotype in BRA.

Boletus subappendiculatus Dermek, Lazebníček & Veselský (in Dermek, Fung. Rar. Icon. Color. 9: 13, pl. 67, 1979)
"Vysoké Tatry (civitas), valles "Račkova dolina" Montibus Tatrae Altae (Slovacia septentrionalis, CSSR), silva coniferarum, sub Picea abiete unacum Vaccinio myrtillo, 17.VIII.1974, leg. A. Dermek." Holotype in BRA.

Boletus theclae Schulzer (Verh. Zool.-Bot. Ges. Wien 20: 178-179, 1870)
[East Slovakia, Blažovská dolina valley near the city of Prešov.] Neither type nor original material have been located.
Alessio (Boletus p. 334, 1985) treated this name in the synonymy of ***Suillus elegans*** (Schum.) Snell.

Calvatia hungarica Hollós (Math. Természettud. Ért. 19: 510, 1901)
"...von Adalbert Gáspár, Forstmeister in Breznóbánya (Kom. Zólyom) eingesand [sent by Adalbert Gáspár from the town of Brezno], wo er den Pilz im spätherbst augelesen hatte." Neither type nor original material have been located.
≡ ***Handkea utriformis*** (Bull.) Kreisel **var.** ***hungarica*** (Hollós) Kreisel (Nova Hedwigia 48: 289, 1989)

Calvatia tatrensis Hollós (Math. Természettud. Ért. 19: 508, 1901)
"Gesammelt von Ferdinand Filarszky in der Hohen Tátra (auf Siroka und auch auf dessen Gipfel 2226 m hoch, im halbreifen und reufen Exemplaren, am 4. August 1899) [Mt. Široká, Vysoké Tatry Mts.]. Auch in der Umgebung des Felkaer-Sees [lake Popradské pleso] gesammelt von dem Führer J. Breuer in den Monaten Juli und August." Holotype in BP.
= ***Calvatia turneri*** (Ellis & Everh.) Demoulin & M. Lange [fide Kreisel, Feddes Rep. 105: 373, 1994]

Clitocybe gibba (Pers.) P. Kumm. var. *adstrigens* Hagara (Česká Mykol. 44: 27, 1990)
"Slovakia, Q77/68: [city of] Bratislava, pars. 'Železná studienka, ad marginem viae silvaticae in silva mixta (Acer, Carpinus), 330 m s. m., 1.VIII.1987." Holotype in BRA.
Because the astringent taste is usually not a persistent character (present only in fresh specimens) we accept this taxon only at the rank of a form.
≡ ***Clitocybe gibba*** (Pers.) P. Kumm.**f.** ***adstrigens*** (Hagara) Lizoň, comb. n.
Basionym: *Clitocybe gibba* (Pers.) P. Kumm.var. *adstrigens* Hagara, Česká Mykol. 44: 27, 1990.

Cortinarius deaki Schulzer (Verh. Zool.-Bot. Ges. Wien 20: 185, 1870)
[East Slovakia, Blažovská dolina valley near the city of Prešov.]
Dubious.

Cortinarius melanotus Kalchbr. (in Fries, Hymenom. Europ., p. 365, 1874)
"In pinetis ad Olaszinum [village of Spišské Vlachy], Hungariae." Neither type nor original material have been located.

Cortinarius szaboi Schulzer (Verh. Zool.-Bot. Ges. Wien 20: 185)
[East Slovakia, Blažovská dolina valley near the city of Prešov.]
Dubious.

Cortinarius szaszi Schulzer (Verh. Zool.-Bot. Ges. Wien 20: 184, 1870)
[East Slovakia, Blažovská dolina valley near the city of Prešov.]
Dubious.

Cortinarius tatrensis Fellner & Landa (in Petrini & Laursen, Arctic Alpine Mycol. 3: 33, 1993)
"Ad terram ad Dryadeo octopetalae, Slovacia, Tatris Beliansensis, in clivo montis Predné Jatky in altitudine 2000 m, 1. 9. 1001, leg. R. Fellner et J. Landa" Holotype in PRM.

Geastrum smardae V. J. Staněk var. *slovenicum* V. J. Staněk (in Pilát, Gasteromycetes, p. 788, 1958)
"Slovensko: [town of] Štubnianske Teplice, VIII.1932 (B. Klika)." [type cited on p. 525] Holotype in PRM.
As stated by Sunhede (Geastraceae, p. 422, 1989) the differencies of this taxon are within the range of the natural variation of the typical variety of ***Geastrum smardae*** V. J. Staněk

Haasiella splendidissima Kotl. & Pouzar (Česká Mykol. 20: 136, 1966)
"Slovakia centralis, in valle Harmanecká dolina, loco Na Rábkinej skale dicto pr. Hor. Harmanec, distr. Ban. Bystrica; inter folia et ad ramos emortuos deiectos arborum frondosarum et coniferarum, 27.IX.1965 leg. Z. Pouzar, F. Kotlaba et D. A. Reid" Holotype in PRM.

Hydnum fuligineo-violaceum Kalchbr. (in Fries, Hymenom. Europ., p. 602, 1874)
"Prope Olaszinum [village of Spišské Vlachy], Scepusii, locis umbrosis, inter acus Pini coacervatas, in plaga Hydnorum feracissima, ubi etiam H. geogenium squamosum, cinereum etc. legi. Sept." Neither type nor original material have been located.
≡ ***Sarcodon fuligineoviolaceus*** (Kalchbr.) Pat. (Essai Tax. Hyménom., p. 118, 1900)

Hygrophorus erubescens (Fr.) Fr. * *capreolarius* Kalchbr. (Icon. Select. Hymenom. Hung. 2: 35, pl. 18/3, 1874)
"In pinetis umbrosis prope Olaszinum [Spišské Vlachy], paucis locis, sed ibi copiose. Sept. Oct." Neither type nor original material have been located.
≡ ***Hygrophorus capreolarius*** (Kalchbr.) Fr. (Hymenom. Eur., p. 407, 1874)

Hygrophorus hazslinszkyi Schulzer (Verh. Zool.-Bot. Ges. Wien 20: 180, 1870)
[East Slovakia, Blažovská dolina valley near the city of Prešov.]
Dubious.

Hygrophorus ipolyii Schulzer (Verh. Zool.-Bot. Ges. Wien 20: 180, 1870)
[East Slovakia, Blažovská dolina valley near the city of Prešov.]
Dubious.

Hygrophorus lucorum Kalchbr. (Icon. Select. Hymenom. Hung. 2: 35, pl. 19/3, 1874)
"Per juga elata montium prope Olaszinum [Spišské Vlachy], Scepusii, locis graminosis subapricis, praesertim sub Laricibus juvenilibus et ad silvarum margines ericetosas. Non omni anno et paucis modo locis obvius, sed ubi nascitus, ingenti, plerumque copia adest. Szept. Oct." Neither type nor original material have been located.

Candusso (Hygrophorus, p. 232, 1997) recognized two forms within *H. lucorum* accepting Kalchbrenner's taxon as a typical form.

Hygrophorus nympha Schulzer (Verh. Zool.-Bot. Ges. Wien 20: 180, 1870)
[East Slovakia, Blažovská dolina valley near the city of Prešov.]
Dubious.

Hygrophorus nympha Schulzer b *unicolor* Schulzer (Verh. Zool.-Bot. Ges. Wien 20: 180, 1870)
[East Slovakia, Blažovská dolina valley near the city of Prešov.]
Dubious.

Hygrophorus nympha Schulzer g *luteus* Schulzer (Verh. Zool.-Bot. Ges. Wien 20: 180, 1870)
[East Slovakia, Blažovská dolina valley near the city of Prešov.]
Dubious.

Hygrophorus pratensis (Pers.) Murrill [var.] *"totus-flavescens"* Schulzer (Verh. Zool.-Bot. Ges. Wien 20: 179, 1870)
[East Slovakia, Blažovská dolina valley near the city of Prešov.]
Dubious.

Hymenochaete carpatica Pilát (Mykologia 4: 124, 1927)
"ad codices Aceris platanoides in Carpatibus Minoribus prope locum Sklena Hut [Sklená huta. east to the village of Sološnica], IV. 1926, leg. Johann Hruby." Holotype in PRM.

Hypochnus atrovirens Bres. (Atti. R. Acc. Sc. Lett. Arti Agiati, ser. 3, 3(1-2): 116, 1897)
"ad ligna mucida arborum frondosarum pr. Prencov [village of Prenčov]." Holotype in S, isotype in FH.
Accepted by Saccardo (Syll. Fung. 14: 228, 1899). Larsen (Tomentella, p. 28, 1974) treated the species as synonym of ***Tomentella rubiginosa*** (Bres.) Maire; for taxonomic position of *T. rubiginosa* see entry below.

Hypochnus elaeodes Bres. (Atti. R. Acc. Sc. Lett. Arti Agiati, ser. 3, 3(1-2): 115, 1897)
"(Hungaria) ad corticem et ligna Betulae etc. pr. Prencov [village of Prenčov]."
Treated as a synonym of *Tomentella granulosa* Bourdot & Galz. by Trotter (Syll. Fung. 26: 686, 1912). Neither type nor original material have been located.
= ***Tomentella punicea*** (Alb. & Schwein.) J. Schröt. [fide Larsen, Tomentella, p. 26, 1974]

Hypochnus fulvo-cinctus Bres. (Atti. R. Acc. Sc. Lett. Arti Agiati, ser. 3, 3(1-2): 116, 1897)
"ad corticem arborum pr. Prencov [village of Prenčov]." Holotype in S.
Accepted by Saccardo (Syll. Fung. 14: 227, 1899).

= ***Tomentella ferruginea*** (Pers.) Pat. [fide Larsen, Tomentella, p. 26, 1974]

Hypochnus rubiginosus Bres. (Atti. R. Acc. Sc. Lett. Arti Agiati, ser. 3, 3(1-2): 116, 1897)
"ad acus Juniperis et folia Quercus [in the environs of village of Prenčov]" Neither type nor original material have been located.
Accepted by Saccardo and Trotter (Syll. Fung. 21: 419, 1912) and by Larsen (Tomentella, p. 28, 1974) in *Tomentella* but treated in the synonymy of ***Tomentella punicea*** (Alb.& Schwein.) J. Schröt. by Koljalg (Tomentella in Eurasia, p. 109, 1996).

Hypochnus sitnensis Bres. (Atti. R. Acc. Sc. Lett. Arti Agiati, ser. 3, 3(1-2): 115, 1897)
"in trunco putris Fagi in Monte Sytno [Štiavnické vrchy Mts.]." Neither type nor original material have been located.
= *Hypochnus tristis* P. Karst. [fide Saccardo, Syll. Fung. 17: 189, 1905]
≡ ***Pseudotomentella tristis*** (P. Karst.) M. J. Larsen

Inocybe fastigiata (Schaeff.) Quél. subsp. *lilofastigiata* Stangl & Veselský (in Dermek & Veselský, Česká Mykol. 31: 190, 1977)
"Kopčany, distr. Senica, Slovacia Res publ. Soc., CSSR, nemore 'Sirková voda' dicto (Pineto–Qurecetum) sub Quercubus, 4.IX.1976." Holotype in BRA.
= ***Inocybe vinosistipitata*** Grund & Stunz [fide Kuyper, Persoonia, suppl. 3: 60, 1986.]

Kneiffiella bombycina P. Karst. var. *slovaca* Svrček (Česká Mykol. 12: 77, 1958)
"Slovakia: montes Slovenské Rudohorie, sub monte 'Fabova hola.' in valle 'Gajdošova dolina' dicta, ad humum et ad truncumputridissimum, probalibiter Sorbi aucupariae, 15.VIII.1950, leg. Svrček. Localitas cca 1200 m s. m. situata est." Holotype in PRM.
= *Tomentellina fibrosa* (Berk. & M. A. Curt.) M. J. Larsen [fide Larsen, Tomentella, p. 109, 1974] ≡ ***Tomentella fibrosa*** (Berk. & M. A. Curt.) Koljalg

Laccaria laccata (Scop.) Cooke var. *subalpina* Singer (Pl. Syst. Evol. 126: 365, 1977)
"CSSR: Slovakia, Hohe Tatra, [Mt.] Solisko, 1900 M. u. M., 4.9.1974, Singer" Holotype in F.
= ***Laccaria laccata*** (Scop.) Cooke **var. *pallidifolia*** (Peck) Peck [fide Mueller, Fieldiana (30): 35, 1992]

Laccaria laccata (Scop.) Cooke var. *tatrensis* Singer (Pl. Syst. Evol. 126: 367, 1977)
"CSSR: Slovakia, Hohe Tatra, Mala studena dolina [valley Malá studená dolina], 13.9.1974, Singer." Holotype in F.
= ***Laccaria laccata*** (Scop.) Cooke **var. *laccata*** [fide Mueller, Fieldiana (30): 35, 1992]

Lactarius albocremeus Z. Schaefer (Česká Mykol. 12: 211, 1958)
"Prope urbem Spišská Belá [now part of the city of Poprad] in montibus Carpaticis Centralibus in prato turfoso sub betulis salicibusque ca 800 m s. mare 11.VIII.1957 Ing. K. Kříž legit." Holotype in BRNM.
= ***Lactarius scoticus*** Berk. & Broome [fide Basso, Lactarius, p. 385, 1999]

Lactarius aranyi Schulzer (Verh. Zool.-Bot. Ges. Wien 20: 183-184, 1870)
[East Slovakia, Blažovská dolina valley near the city of Prešov.]
Dubious.

Lactarius cookei Z. Schaefer (Česká Mykol. 14: 236, 1960)
"Slovakia, Tatra Magra (Carpatorum), [village of] Lendak, leg. Dr. Kubička et Ing. Kříž, 11.8.1957." Holotype in BRNM.
The species is closely related to *L. lignyotus* Fr. and *L. picinus* Fr.

Lactarius dorneri Schulzer (Verh. Zool.-Bot. Ges. Wien 20: 184, 1870)
[East Slovakia, Blažovská dolina valley near the city of Prešov.]
Dubious.

Lactarius subtomentosus Z. Schaefer (Česká Mykol. 14: 237, 1960)
"Ad piceti marginem in Slovakia centrali. Lázně [spa and city of] Sliač, 23.11.1958, leg. Ing. Kříž." Holotype in BRNM.
The species is, according to the original description, related to *L. ichoratus* Fr. Cooke's plate (Ill. Brit. fung., no. 1010, 1888) should represent this taxon. Basso (Lactarius, p. 474, 1999) noted that fruitbodies are similar of those of *L. helvus* (Fr.) Fr.

Lactarius tatrorum Z. Schaefer (Česká Mykol. 12: 211, 1958)
"In montibus Tatra Belaënsis Carpatorum Centralium in declivitate orientali montis Bujačí solo calcareo sub Salice reticulata, Pino mugho, Dryade octopetala et Carice tatrorum ca 1900 m s. mare 14.VIII. 1957 Dr. J. Kubička et Ing. K. Kříž legerunt." Holotype in BRNM.
= *Lactarius nanus* J. Favre [fide Basso, Lactarius, p. 144, 1999]

Lasiochlaena anisea Pouzar (Česká Mykol. 44: 97, 1990)
Ischnoderma resinosum (Fr.) P. Karst. sensu auct.
"Bohemoslovacia, Slovacia orientalis, in ripa lacus "Morské oko" ap. Remetské Hámre prope Michalovce, montes Vihorlat, ad truncum iacentem Fagi sylvaticae, 21.X.1987." Holotype in PRM.

Leccinum thalassinum Pilát & Dermek (Hríbovité Huby, p. 146, pl. 82, 1974)
"Sub Betulis solo arenoso prope Gbely, Cechoslovaciae - Slovakiae occidentalis, ubi hunc fungum primum Aurelius Dermek anno 1967 observavit." Holotype in PRM.

Lenzites pinastri Kalchbr. (Icon. Select. Hymenom. Hung. 3: 49, pl. 30/3, 1875)
"In pinibus silvestribus vallis Kundratka prope Olaszinum. Autumno." Neither type nor original material have been located.

Accepted by Saccardo (Syll. Fung. 5: 640, 1887). According to the original description the species differs from *L. betulina* only by anastomozing gills.
= ***Lenzites betulina*** (L.) Fr. [fide Pilát, Atlas Champ. Eur. 3: 612, 1942]

Lycoperdon pseudocepaeformis Hollós (Math. Térmészettud. Értes. 19: 511, 1901)
"Gesammelt von V. Greschik bei Löcse [town of Levoča] (Kom. Szepes) auf moosiger, schattiger Wiese, am Marienberge. Frische Exemplare im August." Neither type nor original material have been located.
According to the original description the species differs from *Lycoperdon cepaeformis* Bull. [= ***Bovista pusilla*** (Batsch) Pers.] only by slightly larger spores and is probably conspecific with that taxon.

Macrolepiota mastoidea (Fr.) Sing. var. *atrobrunnea* Dermek (Fung. Rar. Icon. Color. 14: 11, 1985)
"ČSSR, Slovacia occidentalis, Kopčany, in silva mixta (Pinus, Quercus), 27.X.1974, A. Dermek legit." Holotype in BRA.
= ***Macrolepiota rickenii*** (Velen.) Bellú & Lanzoni [fide Canduso & Lanzoni, Lepiota, p. 557, 1990]

Marasmius carpaticus Kalchbr. (Math. Természettud.Közlem. 5[1867]: 253, pl. 2/2, 1868)
"Gregarius, in pinetis montanis, inter acus delapsas et ad marginem steriles silvarum. Ut videtur, per totam Hungariam borealem frequesns." Syntype: Rabenhorst, Fungi Europ. no. 1102.
≡ ***Marasmius wynnei*** Berk. & Broome **var. *carpathicus*** (Kalchbr.) Antonín ([Libri Bot. 8] Marasmius 1: 120, 1993)

Odontia conspersa Bres. (Atti. R. Acc. Sc. Lett. Arti Agiati, ser. 3, 3(1-2): 100, 1897)
"(Hungaria) ad truncos Alni glutinosae, Populi tremulae etc. pr. [village of] Prenčov." Holotype in S.
= *Phanerochaete rimosa* (Cooke) Burdsall [fide Burdsall, Phanerochaete, p. 107, 1985] = ***Scopuloides hydnoides*** (Cooke & Massee) Hjorstam & Ryvarden

Odontia papillosa Bres. (Atti. R. Acc. Sc. Lett. Arti Agiati, ser. 3, 3(1-2): :98–99, 1897)
"(Hungaria) ad corticem Aceris campestris et in ligno Quercus pr.[village of] Prenčov." Type or original material have not been located (BPI has specimen by Kmeť from Prenčov on Abies sp.). This is a later homonym of *Odontia papillosa* (Fr.) P. Karst.
= ? ***Hyphodontia nesporii*** (Bres.) J. Erikss. & Hjorstam [fide Eriksson, Hjorstam & Ryvarden, Corticiaceae North Eur. 4: 655, 1976]

Oligoporus septentrionalis Vampola (Česká Mykol. 45[1991]: 147, 1992)
"Slovacia, sub cacumine montis 'Pátria' ap. Spišské Podhradie (s. m. ca 1100 m), montes Branisko, ad truncum putridum Piceae abietis, 5. IX. 1970, leg. F. Kotlaba." Holotype in PRM.

Phaeomarasmius excentris Scherff. (Hedwigia 36: 289, 1897)
"Ad corticem unicae Pyri communis viventis, Igló [city of Spišská Nová Ves], Hungaria. Non frequens, per plures annos observatus. Aestate-autumno." Neither type nor original material have been located.
= ***Phaeomarasmius horizontalis*** (Bull.) Kühner [fide Singer, Schweiz. Z. Pilzk. 34: 44, 1956]
P. excentris is the type species of the new genus *Phaeomarasmius* erected by Scherffel (l. c.).

Polyporus evonymi Kalchbr. (Math. Természettud. Közlem. 5[1867]: 261, pl. 2/4, 1868)
"Ad radices Evonymi europeai et verrucosi in dumetosis prope Hernadum [river Hornád]. Vere exaridus, autumno iterum stratose reviviscint." Neither type nor original material have been located.
Accepted by Saccardo (Syll. Fung. 6: 182, 1888) as *Fomes lonicerae* (Weinm.) Gillet subsp. *evonymi* (Kalchbr.) Sacc.
= ***Phellinus ribis*** (Schumach.) P. Karst. [fide Quélet, Bull. Soc. Bot. France 23: 149, 1876]

Polyporus hoehnelii Bres. (in Höhnel, Sitzungsber. Kaiserl. Akad. Wiss., Math.-Naturwiss. Cl. 121: 6, 1912)
Höhnel (l. c.) cited two collections: "An morschen Stämmen von Fagus sylvativa und Carpinus betulus im Wienerwald..." and "Bei Schemnitz [city of Banská Štiavnica] in Ungarn von Kmet auf Rotbuch stämmen gesammelt." Ryvarden (Mycotaxon 33: 313, 1988) noted only "Hungary" refering probably to Kmet"s specimen. Accepted by Trotter (Syll. Fung. 23: 360, 1925). Neither type nor original material have been located.
≡ ***Antrodia hoehnelii*** (Bres.) Niemalä (Karstenia 22: 11, 1982)

Polyporus kmetii Bres. (Atti. R. Acc. Sc. Lett. Arti Agiati, ser. 3, 3(1-2): 70-71, 1897)
"in ramis emortuis Quercus "Sbojnicko bralie" pr. Prenčov."
Listed by Saccardo (Syll. Fung. 14: 175, 1899). Holotype in S, isotype in BRA.
≡ ***Tyromyces kmetii*** (Bres.) Bondartsev & Singer (Ann. Mycol. 39: 52, 1941)

Polyporus melleo-fuscus Bolla (Math. Természettud. Közlem. 12[1874]: 131, 1876)
"In silvis montanis ad desectos Tiliarum truncos circum Posonium [city of Bratislava], autumno in primum ver." Neither type nor original material have been located.
Dubious.

Polyporus scutiger Kalchbr. (Math. Természettud. Közlem. 5: 259, pl. 2/3, 1868)
"Mogyoróbokrok közt, a Sz.-Olaszi hegységen [in the mountains of the village Spišské Vlachy]." Neither type nor original material have been located.
This is a later homonym of *Polyporus scutiger* Fr. (1828). New name: *Polyporus kalchbrenneri* Fr. (Hymenom. Eur., p. 531, 1874: "In coryletis ad Olaszinum Hungariae."). For details see Lizoň (Czech Mycol. 49: 166, 1997). Accepted by Saccardo and Traverso (Syll. Fung. 20: 504, 1919) as *Polystictus kalchbrenneri* (Fr.) Cooke.

= *Polystictus tomentosus* (Fr.) P. Karst.[fide Pilát, Atlas Hub. Evrop. 1: 583, 1942] ≡ ***Onnia tomentosa*** (Fr.) P. Karst.

Poria ambigua Bres. (Atti. R. Acc. Sc. Lett. Arti Agiati, ser. 3, 3(1-2): 84, 1897)
"ad truncos Fagi, Carpini et Piri communis pr. Prencov [village of Prenčov]."
Listed by Saccardo (Syll. Fung. 14: 189, 1899). Holotype in BPI.
= ***Oxyporus latemarginatus*** (Dur. & Mont.) Donk [fide Lowe, Polypor. N. America, Poria, p. 17, 1977]

Poria confusa Bres. (Atti. R. Acc. Sc. Lett. Arti Agiati, ser. 3, 3(1-2): 87, 1897)
"ad ramos corticatos Alni glutinosae 'Uhrinojo dolinka' pr. Prencov [village of Prenčov]."
Listed by Saccardo (Syll. Fung. 14: 189, 1889). Holotype in S.
= ***Schizopora flavipora*** (Cooke) Ryvarden [fide Ryvarden, Mycotaxon 33: 307, 1988]

Poria fulvescens Bres. (Atti. R. Acc. Sc. Lett. Arti Agiati, ser. 3, 3(1-2): 81, 1897)
"in trunco Populi tremulae in Monte Sytno pr. Prencov [village of Prenčov]." Holotype in BPI.
= *Poria aneirina* "Somm." [fide Bresadola, Ann. Mycol. 18: 69, 1920]
≡ ***Ceriporiopsis aneirina*** (Fr.) Domański

Poria nigrescens Bres. (Atti. R. Acc. Sc. Lett. Arti Agiati, ser. 3, 3(1-2): 83, 1897)
"ad truncos emortuos Abietis pectinatae in Monte Sytno pr. Prencov [village of Prenčov]." Holotype in S, isotypes in BPI and BRA.
Accepted by Saccardo (Syll. Fung. 14: 190, 1899).
= ***Rigidoporus crocatus*** (Pat.) Ryvarden [fide Ryvarden, Mycotaxon 33: 317, 1988]

Russula alba Schulzer (Verh. Zool.-Bot. Ges. Wien 20: 182, 1870)
[East Slovakia, Blažovská dolina valley near the city of Prešov.]
Dubious.

Russula dryadicola Fellner & Landa (in Petrini & Laursen, Alpine Arctic Mycol. 3: 34, 1993)
"Hlúpy vrch: 2020 m, Dryas octopetala, Salix reticulata, 1. 9. 1991" Holotype in PRM.
The varietal epithet "alpina" was later validated (Singer, Hedwigia 66: 197, 1926). Fellner and Landa proposed a new epithet at specicific rank rather then raising Singer's epithet, which was their option under the Code.

Russula rugosa Schulzer (Verh. Zool.-Bot. Ges. Wien 20: 182, 1870)
[East Slovakia, Blažovská dolina valley near the city of Prešov.]
Dubious.

Skepperia carpatica Pilát (Bull. Soc. Mycol. France 43: 55, 1927)
"Ad truncum putrescentem Piceae excelsae ad rivum montanum, Tatra Magna Carpatorum Centralium inter Novy Smokovec et Slezsky Dom sub monte Gerlachovka in alt. ca 1300 m., 23, VII, 1926, ipse legi." Holotype in PRM?
≡ ***Cotylidia carpatica*** (Pilát) Huijsman (Bull. Soc. Mycol. France 70: 57, 1954)

Stereum subtomentosum Pouzar (Česká Mykol. 18:147, 1964)
"Slovakia orientalis: montes 'Vihorlat', inter montes 'Fetkov' et 'Vortas'; ad truncum Fagi silvaticae, 3.VIII.1961." Holotype in PRM.

Thanatephorus ovalisporus Čížek & Pouzar (Česká Mykol. 46[1992]: 62,1993)
"Bohemoslovacia, Slovacia, montes Slovenske rudohorie, sylva boreo a Vrchslatina ap. Lom nad Rimavicou prope Detva; ad ramum Piceae abietis, cca 950 m s. m., 29.VII.1989, leg. Z. Pouzar." Holotype in PRM.

Tricholoma singeri Kuthan (Česká Mykol. 36: 10, 1982)
"CSSR, NW Slovakia, Raková distr. Cadca (village-part Petrová), in the valley called Korcháň, in coniferous wood on grassy moss-rich ground under Pinus and Juniperus (+Picea), 29.IX.1975." Holotype in PRM.
The species was erected as different from *Tricholoma maluvium* Fr. Bon and Riva (Atti del Convegro Intern. di Borgo Val di Taro, p. 33, 1986) proposed for the same taxon probably a superfluous new name *Tricholoma joachimii.*

Tulostoma atrum Bolla (Math. Természettud. Közlem. 12[1874]: 132, 1876)
"In pinetis montanis ad Posonium vere in autumnum." Neither type nor original material have been located.
= *Geastrum bryantii* Berk. [fide Hollós, Gasterom. Ungarns, p. 151, 1904; he has saw Bolla's specimen in Haynald's collection] = ***Geastrum striatum*** DC.

Tulostoma kotlabae Pouz. (in Pilát, Gasteromycetes, p. 814-815, 1958)
"Slovensko: Kúty, sev. od Bratislavy; u trati blíže místa 'U krúžku' 25.IX.1954 (Kotlaba)." [type cited on p. 599] Holotype in PRM.

Xerocomus chrysenteron (Bull.) Quél. var. *robustus* Dermek (Čas. Českoslov. Houb. 50: 80, 1973)
"[near the village of] Dubodiel (distr. Trenčín), 23.IX.1972, leg. A. Dermek." Holotype in BRA.
= *Boletellus fragilipes* (C. Martin) Kuthan [fide Alessio, Boletus, suppl., p. 67, 1991] = ***Xerocomus pruinatus*** (Fr. & Hök) Quél.

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We would like to thank Drs. Richard P. Korf (Cornell University, Ithaca) and Vladimír Antonín (Moravian Museum, Brno) for their valuable comments on drafts of this manuscript and pre-submission reviews. Help with information about type specimens by Drs. János Gönczöl and Gizella Vasas (BP), and Ivona Kautmanová (BRA) is appreciated. Research of the senior author was partially supported by an Anna E. Jenkins bequest (Cornell University, Ithaca) and grant VEGA no. 5048 (Slovak Academy of Sciences, Bratislava).

MYCOTAXON

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VALIDATION OF NANNFELDT'S ORDINAL NAME HELOTIALES

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ABSTRACT

The ordinal name Helotiales Nannfeldt, in common use for over 60 years, was not validly published, since it was based on an invalidly published family name, Helotiaceae Rehm. Rehm's family name has recently been conserved, but since the ordinal name is still technically incorrect, steps are taken here to validate it.

KEYWORDS: Leotiales, nomenclature, invalid publication

Nannfeldt's (1932) exceptionally important contribution to the systematics of inoperculate discomycetes has led to adoption of his system and nomenclature by the great majority of discomycete workers. Unfortunately a technical problem invalidates the ordinal name Helotiales, which he proposed. The name was based on a family name, Helotiaceae Rehm, which lacks nomenclatural status (Korf & al., 1996). This led Carpenter (1988) to propose Leotiales Carp. as a nomen novum to replace Helotiales. Even though many authors have since followed Carpenter, that ordinal name is also not validly published (Korf & Lizon, 2000). Following conservation of Helotiaceae Rehm by the most recent International Botanical Congress, it is now appropriate to propose a valid ordinal name for these fungi. We validate Nannfeldt's name by providing it with a Latin description, which becomes necessary when publishing a new name under the International Code of Botanical Nomenclature (Art, 36.1). The description is taken directly from Nannfeldt's German text in his key to orders:

HELOTIALES Nannfeldt,. ord. nov.

Cum algis numquam symbioticae; saprophyticae vel parasiticae; ascis inoperculatis, ascarum parietibus exilibus, clavatis, pariete apicali nec vel parum incrassato; sporis rare sphaericalibus, elongatis, numquam filiformi-cylindricis nec in "part-spores" *discedentibus; paraphysibus non cartilagineis, tantum rare epithecium formantibus; apotheciis plerumque perumper perdurantibus, carnosis, rare coriaceis vel cartilagineis.*

Typus: *Helotium* Pers. 1801 *non* Tode 1791, = *Cudoniella* Sacc. [type of the family name Helotiaceae Rehm, *nom. conserv.*]

ACKNOWLEDGEMENTS

We thank Professor Werner Greuter, Berlin, for his consultation in this matter, and Professor William Dress, Bailey Hortorium, Cornell University, for providing the Latin translation for the new ordinal name.

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MYCOTAXON

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ONLINE RESOURCES FOR FUNGAL TAXONOMY & NOMENCLATURE:

Field Guides

Kathie T. Hodge
Cornell University, Ithaca, NY, USA
Maitainer, WWW Virtual Library: Mycology
http://mycology.cornell.edu/

WHAT IS THIS MUSHROOM?

Field guides are more than just lists of species names. They appeal to those who don't identify fungi for a living; those who have something funny growing in their garden; who recall their grandmother's wonderful mushroom stew, or who are just beginning to learn about fungi. There aren't as many general field guides on the web as one might expect.

Fungi of the San Francisco Bay Area (MykoWeb)	http://www.mykoweb.com/BAF/
The F-Files (New Zealand fungi)	http://PLUG.co.nz/mush/
Forest Fungi of New Zealand	http://fungi.co.nz/forest/

THE BENEFITS OF WEB PUBLISHING

The photographs! Disk space is cheap; many different photos and drawings can illustrate a single taxon. Data can be updated as names change and errors are detected. In more sophisticated applications, users can exercise control over the presentation to suit their needs and connection speed. Hypertext glossaries can be provided through pop-up menus or links. Indices can be augmented by high-powered search interfaces. Mike Wood and Fred Stevens (MykoWeb) point out another advantage of online guides: there is no publisher to demand that common names be invented for mushrooms without them!

THE DOWNSIDE

There are disadvantages to web publishing, to be sure. Royalties that accrue from publishing a popular book are hard to come by online; we await more user-friendly methods to reward authors for their hard work. Information quality is important, especially when recommendations are made as to edibility or medicinal use, since internet sites are less likely than books to be peer-reviewed (see this column, vol. 71).

Access can also be a problem. You might bring your notebook computer on a foray, but what about your internet connection? Mike Wood and Fred Stevens of MykoWeb have solved this problem by offering their field guide in a compact disk version.

PRACTICALITIES

A slow internet connection can destroy the effect of a well-illustrated site, and the appearance of html documents is held hostage to the idiosyncratic rendering habits of web browsers like Netscape and Explorer. Developing a clean and browser-neutral layout is a challenge for web field guide authors. Users, even those with slow connections or old computers should be able to quickly navigate a site. The Virtual Field Guide, for example, is impressive in scope and coverage, but its hierarchical organization makes it laborious to browse. Hypertext mark-up language can easily produce simple dichotomous keys; synoptic keys are gloriously suited to computerization:

The Virtual Field Guide	http://www.bioimages.org.uk/HTML/T74.HTM
Dichotomous key to British basidiomycetes	http://www.personal.u-net.com/~ivyhouse/Normkey.htm
MycoKey (synoptic key to basidiomycetes)	http://www.mycokey.com/

My dream site has multiple access routes: dichotomous or synoptic keys, a thorough index, a search interface, and perhaps a gallery of thumbnail images. The user selects a display format: a terse caption and single photo for an amateur with a slow connection; a technical description and micrographs for a professional with a direct line. It discusses the geographic distribution and cross-indexes the look-alikes of each species.

COOPERATIVE FIELD GUIDES?

Another potential advantage of the online field guide is the potential for multi-authored and distributed sites. Class projects like that of Rytas Vilgalys' mycology class at Duke University illustrate the potential for these multi-authored sites that share a common format. Flemming V. Larsen's index of fungal photos on the internet shows some of the possibilities of distributed work. The Open Directory Project is more ambitious, but is not yet fully realized. It attempts to sort all of the internet through a filter of expert volunteers and come up with a page on every organism (and every other topic, for that matter). Thus every fungal species would, in theory, have a home page on the WWW, although surely not in my lifetime…

Mushrooms of North Carolina (Duke Univ.)	http://www.botany.duke.edu/fungi/
Fungi Images on the Net	http://www.in2.dk/fungi/
Open Directory Project (Fungi section)	http://dmoz.org/Science/Biology/Taxonomy/Taxonomy_Map/Fungi/

MYCOTAXON

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BOOK REVIEWS AND NOTICES[1]

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GENERAL

Fungal Biology: Understanding the Fungal Lifestyle. By D. H. Jennings and G. Lysek. Second Edition. 1999. Bios Scientific Publishers, 9 Newtec Place, Magdalen Road, Oxford OX4 1RE, UK. Pp. xvi + 166. ISBN 1 85996 108 8. Price £ 18.95.

Mycological textbooks are a key to the recruiting of the next generation of mycologists. A new edition of this book, first published in 1996, is welcome as it presents fungi in an appealing way for students with chapters on topics such as Water: living with desiccation, Spore Germination: starting a new colony, Using Light, Competition: living with neighbours, and Fungi and Man [*sic* !]: interacting with our lifestyle. It is well illustrated by clear line drawings and half-tones, and some coloured photographs are included. Few lecturers would come up with the same coverage if asked to produce such a student text, but if you are involved in teaching mycology and need a text that is not taxonomically arranged do give this well-presented book a look. Taxonomic hairs may bristle a little, however, to see class and phylum terminations of names reversed in Table 1, although class names are used correctly in a helpful Appendix which lists the genera mentioned by order. I was at first heartened not to see 'Deuteromycetes' accepted as a class in Table 1, but then saddened to find them listed as a formal class in the Appendix.

Microbial Endophytes. Edited by Charles W. Bacon and James F. White Jr. 2000. Marcel Dekker, 270 Madison Avenue, New York, NY 10016, USA. Pp. ix + 487. ISBN 0 8247 8831 1. Price US $ 175.

Although not primarily a systematic work, attention is drawn to this first major book devoted entirely to microbial endophytes for two reasons. First, Orlando Petrini's 1991 and very broad definition is adopted: 'endophytes colonize symptomlessly the living, internal tissues of their host, even though the endophyte may, after an incubation or latency period, cause disease' (p. 5). As a result, bacterial endophytes and some mycorrhizas are covered. Second, it includes contributions on the Rhynie Chert fungal ecosystem (Thomas and Edith Taylor), molecular systematics of grass endophytes (James White, Ponka Reddy and Charles Bacon), hybridization and cospeciation (Christopher Shardl and Heather Wilkinson), evolution of the habit in *Glomales,* and the significance of secondary metabolites in coevolution with grasses (Geoffrey Lane, Michael Christensen and Christopher Miles). While perhaps to some extent understandably biased towards grass endophytes and endomycorrhizas, and further to chemical interactions and products (some of which are now known to be bioactive and of pharmaceutical interest in humans), I was somewhat surprised not to see chapters devoted to overviews of the wide range of endophytes now being isolated from diverse hosts in both temperate and tropical regions. This is partly explained by the book having its origins in a symposium primarily devoted to grass endophytes held in Woods Hole. The editors indicate that the topics covered are not exhaustive, but as additional contributions were invited after the meeting, I feel that an opportunity to make an exciting subject even more alluring by drawing attention to some additional horizons has been missed. Nevertheless, if you work on the systematics of endophytes or are interested in coevolution, you are unlikely not to find something of interest here.

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[1] Books for consideration for inclusion in this column should be sent to the Book Review Editor in the first instance: David L. Hawksworth, MycoNova, 14 Finchley Lane, Hendon, London NW4 1 DG, UK; tel/fax [+44] (0) 20 8203 4282; e-mail myconova@btinternet.com. Unsigned reviews and notices are by the Book Review Editor.

Phytopathogenic Fungi from South Africa. By Pedro W. Crous, Alan J. L. Phillips and Alice P. Baxter. 2000. Department of Plant Pathology Press, University of Stellenbosch, P. Bag XI, Matieland 7602, South Africa. Pp. iv + 358. ISBN 0 7972 0777 5. Price not indicated.

This work aims to provide an updated list of the plant pathogenic fungi occurring in South Africa. The fungi are arranged by host family, host genus, and host species. Mycologists looking for particular fungi will be relieved to find a full index of fungus names, and most users will also welcome the index to the common names of hosts. Information on the diseases caused, synonyms, distribution in the country, and literature references are provided. Helpful indications of the nomenclatural status of synonyms in particular are provided, but I did wonder why the Berlin Code of 1988 and not the Tokyo 1994 *Code* was cited. The book is well-produced, hard-bound, and with a dust jacket; it should stand up well to use in quarantine laboratories. The book was developed from a database started in 1991, and while it will inevitably quickly 'date', such snap-shots of the situation at a single point in time provide a lasting landmark, as did Ethel Doidge's classic compilation of South African fungal records published in 1950.

TECHNIQUES

Marine Mycology: A Practical Approach. Edited by Kevin D. Hyde and Stephen B. Pointing. February 2000. [Fungal Diversity Research Series No. 1.] Fungal Diversity Press, Centre for Research in Fungal Diversity, Department of Ecology and Biodiversity, University of Hong Kong, Pokfulam Road, Hong Kong. Pp. v + 377. ISBN 962 85677 1 3. Price not indicated.

While interest in marine mycology has expanded dramatically during the last 20 years, there has not been a book devoted to the techniques used in the exploration of the fungi of this fascinating habitat. That deficiency is addressed here by 17 authors. Chapters cover the isolation and culture of filamentous fungi and thraustochytrids, diseases of marine animals, long-term maintenance of cultures, methods of determining biomass and productivity, physiological studies, assessment of wood decay, lignocellulolytic enzyme assays, screening for secondary metabolites, and molecular techniques.

However, excluding the glossary and indices, almost half the book (135 pages) is devoted to systematics. First, Kevin Hyde, Venkkateswara Sarma and Gareth Jones provide an overview and list the 444 formally described species of 'higher' marine fungi together with their places of publication, 360 of which are *Ascomycota*, 10 of *Basidiomycota*, and 74 of mitosporic fungi. It is remarkable to note that the number of marine fungi known has increased by over 100 % since *Marine Mycology: the higher fungi* was published by Jan and Erika Kohlmeyer in 1979; further, the rate of description has accelerated since 1991, when 321 species were known. The authors do not speculate on how many species remain to be found, but note that some habitats are as yet scarcely investigated, including fungi on corals, calcareous tubes and coralline algae, and crustacean guts. This major survey is then followed by a pictorial key prepared by Hyde and Sarma covering all species described up to January 2000; this includes line drawings of the spores combined with keys to species including measurements and other details and will greatly facilitate identification; the model is worth looking at by mycologists preparing keys to other ecological groups of fungi. Finally, Sarma and Hyde provide a synoptic key to genera divided into those occurring on animals, algae, and plant substrates (other than algae); the characters used relate to, for example, ascoma and ascus type, ascospore appendages, sizes, septation and colour. Taken together, this triumvirate of chapters serves as an excellent update to the keys in its eponymous predecessor of 1979.

As in the 1979 volume, lichen-forming species and yeasts are still largely omitted; that is evidently a jump that needs careful consideration when a new edition or successor volume is contemplated.

The book concludes with a glossary, which includes some photographs and line drawings, and separate fungal and subject indices. The book is hard-bound with an attractive laminated cover and should stand up well to the laboratory use it will inevitably receive. Fungal Diversity Press are to be congratulated on the standard attained in their first book, and for producing a volume which will be of lasting value and a 'must' for all who work on the systematics, physiology, and exploitation of marine fungi.

Molecular Variability of Fungal Pathogens. Edited by P. D. Bridge, Y. Couteaudier and J. M. Clarkson. August 1998. CAB International, Wallingford, Oxon OX10 8DE, UK. Pp. xiv + 319. ISBN 0 85199 266 8. Price £ 55 (US $ 100).

While one might wonder at the scope for yet another multiauthored book on molecular methods in mycology from CAB International, this is of potential interest as it largely comprises case studies of what is known about particular pathogenic fungi. As such fungi tend to be amongst the most fully researched, the discovery of what is happing in them may serve as a guide to what is yet to be discovered of the evolution and variation amongst other fungi. This work, with 19 chapters and 60 contributors, is based on an EC-sponsored workshop held in Evian, France, on 14-17 September 1997. Fungi featured include *Aspergillus fumigatus, Beauveria* (3 chapters), *Colletotrichum, Fusarium oxysporum, Magnaporthe grisea, Metarhizium anisopliae, Trichoderma,* and *Verticillium lecanii.* Other contributions cover topics as wide ranging as variability in sexually reproducing plant pathogens, parasexuality, nematophagous fungi (2 chapters), neural networks, and even viruses of fungi. The emphasis on entomopathogenic and nematophagous species reflects the nature of the EC programme and plant pathogens in particular receive less attention than one might expect from the title. The emphasis is on variation within species, but systematists will be interested to see J. Mugnier's novel unrooted star-like phylogenetic tree of the ascomycetes based on ITS sequences which includes some new ordinal names: *Botryosphaeriales, Elsinoales, Herpotrichiellales, Magnaporthales, Mycosphaerellales, Passerinellales, Plectosphaerellales,* and *Sclerotiniales* – these names, and those of some new families and a species also mentioned were not validly published here, nor in a printed version of the 'star' that has been in circulation for some years; such a contribution, lacking detailed information on taxon selection and the procedures followed ,would have been better submitted to a refereed journal. This is a book that can be dipped into with profit, but is by no means an overall review of this rapidly developing field.

Photography with a Microscope. By Fred Rost and Ron Oldfield. 17 February 2000. Cambridge University Press, The Edinburgh Building, Shaftesbury Road, Cambridge CB2 2RU, UK. Pp. ix + 278. ISBN 0 521 77096 3. Price £ 55 (US $ 90).

The beautiful *Penicillium funiculosum* in darkground illumination on the cover suggests this is a book which would benefit mycologists. It is. And it is not just about photography as there is much basic information on microscopes and their use, as well as special optical techniques such as darkground, polarization, phase contrast, differential interference contrast (DIC), fluorescence, infrared and ultraviolet, and stereomicroscopy. Digital, confocal and video techniques are also treated, as are the selection of materials and drawing. Appendices on Care and Maintenance and Troubleshooting (with some helpful illustrations) are particularly valuable. Mycologists rarely receive any formal training in microscopy, let alone photomicroscopy, yet are expected to produce top-quality prints for publication. Although not cheap, such a book would be a wise investment for communal shelves in the laboratories of graduate students, or for a department's photographer to have on hand to point out what could have been done.

LICHEN-FORMING FUNGI

Nordic Lichen Flora. Volume 1. Introductory Parts. Calicioid Lichens and Fungi. Edited by the Nordic Lichen Society. 1999. Bohuslän '5, Uddevalla, Sweden. [Obtainable from Svenska Botaniska Föreningen, c/o Fytoteket, Norbyvägen 16, 752 36 Uppsala, Sweden.] Pp. 94, 81 maps, 11 coloured plates. ISBN 91 972863 3 8. Price not indicated.

This is the first volume of a long-awaited series which eventually will cover all the lichens known in Bear Island, Denmark, the Faeroe Islands, Finland, Greenland, Iceland, Jan Mayen, Norway, Svalbard and Sweden. It is a remarkably ambitious project conceived by the Society and being carried forward by an Executive Committee comprising leading lichenologists of the region. Following some brief introductory sections, this first volume comprises a treatment of the 82 species of calicioid lichens and allied non-lichenized fungi by Leif Tibell. Keys to genera and species are provided, and under each species full bibliographical citations, descriptions, common names, conservation status, chemistry, habitat, distribution (including outside the Nordic countries), and notes are provided. Maps and colour habit photographs are also included. No illustrations of microscopic features are presented, and while in this case many can be found in previous publications by the author, this will not be so for many groups still to be treated. It was pleasing to see that non-lichenized and lichenicolous species included and I trust this practice will be emulated for other genera with mixed biologies in future parts. This volume is in effect the distillation of almost 30 years work by the author on calicioid fungi and it is marvellous now to have the various generic treatments brought together, and further to have his views on the often critical species of *Chaenothecopsis* presented. It is envisaged that volumes will appear every one or two years, and if the standards attained in this treatment can be maintained, then the series will be destined to gradually become one of the worlds' most important references for lichen identification in the Northern Hemisphere.

The Lichens of British Columbia. Illustrated Keys. Part 2 – Fruticose Species. By Trevor Goward. 1999. [British Columbia Ministry of Forests, Special Report Series No. 9.] Ministry of Forests Research Program, Victoria, BC. [Obtainable from Crown Publications, 521 Fort Street, Victoria, BC V8W 1E7, Canada.] Pp. v + 319, 320 line drawings, 128 maps, 1 coloured map. ISBN 0 7726 3961 2, ISSN 0843-6452. Price not indicated.

Part 1 of this work appeared in 1994 and covered 327 foliose and squamulose species. In that part, Trevor Goward was assisted by Bruce McCune and Del Meidinger, but here he tackles the in many ways more difficult 309 fruticose species alone, but with the support of many specialists inside and outside North America who have had inputs to particular generic accounts. The basic approach is similar, using keys with helpful line illustrations incorporated on the left margin, but much fuller information is given on the ecology, distribution, chemistry, and variation, and sometimes extensive notes are added. All species are given common names, though I doubt that some such as 'Frog stubble' for *Calicium viride* nor 'Because-it's-there' for *Cladonia umbricola* will be readily taken up. Distribution maps are included for 128 species. A very broad view of fruticose species is deliberately taken, in that calicioid taxa with crustose or no lichenized thalli but stalked apothecia, and filamentous lichens where the hyphae surround filamentous algae (e.g. *Cystocoleus, Ephebe*) are incorporated; while unexpected, this adds significantly to the value of the book as few illustrations of some of these groups are available in North America.

A particular interest was taken in *Chaenothecopsis,* with only 13 of the 22 species treated having been described; the new taxa are given working names in inverted commas and parentheses and presumably will be published separately in due course. The author's extensive field experience is evident throughout, but especially in the Notes. For example, to give a flavour of the insights, in *Alectoria,* he notes that hypermaritime material of *A. imshaugii* has rounded and not angular branches and may represent a different species, and that *A. vancouverensis* appears to intergrade with *A. sarmentosa* despite the chemical differences; and in *Cladonia, C. ecmocyna* subsp. *intermedia* is noted to possibly include two distinct taxa differing in pruinosity, podetial squamules, and habitat. Selected synonyms are included, and erroneous reports – including several recent ones are discussed. He falls into one common minor nomenclatural trap, incorrectly citing authors of species names when referring to an infraspecific taxon other than the type; for instance, *Cladonia gracilis* subsp. *vulnerata* Ahti should not be cited as *C. gracilis* (L.) Willd. subsp. *vulnerata* Ahti to follow the practice of the *Code* (e.g. in Arts 24-26, 46 and 49). It is also perhaps to be regretted that the work was completed before molecular data overwhelming showed that *Cladina* has to be regarded as a synonym of *Cladonia.*

Although this book has a clear regional focus, and is designed primarily for those wishing to identify lichens in British Columbia, the observations included mean that it merits consultation by all systematists working on macrolichens in the broadest sense. The author is to be congratulated on producing a work that deserves to be widely available to lichenologists internationally.

Rödlistade Lavar i Sverige Artfakta. Edited by Göran Thor and Lars Arvidsson. 1999. ArtDatabanken, SLU, Box 7007, 750 07 Uppsala, Sweden. Pp. 528., 126 pages of coloured plates. ISBN 91 88506 20 7. Price not indicated.

This book provides data on 234 of the 238 lichens on the Swedish red data list of endangered and threatened lichen species. For each species a data sheet comprising notes on distinguishing features, status, ecology, threat, conservation measures proposed, names used, pertinent literature references, distribution maps (pre- and post- 1980 records, and sites where the species has been lost, are distinguished), and exceptionally fine coloured photographs. The latter are mainly by Ulf Arup and Svante Hultengren. It is salutary to reflect that over 20 % of Sweden's lichens are recognized as under threat, and I am pessimistic as to the effectiveness of actions recommended in the long-term. Fortunately, some of the species are still widespread and relatively unthreatened elsewhere in Europe (e.g. *Flavoparmelia caperata*). However, this book is listed in this column primarily because of its photographs and distribution maps which will be a useful adjunct to existing Nordic lichen identification texts.

BASIDIOMYCETES

Lactarius. By Maria Teresa Basso. 1999. [Fungi Europaei. Vol..7.] Mykoflora, Alassio, Italy. Pp. 845. ISBN 88-87740-00-3. Price Ll 120,000.

A pleasantly 'user-friendly' introduction discusses all the microscopic characters known to be significant in *Lactarius* taxonomy, with detailed instructions on how best to observe them. A historical summary of the systematics covers Fries and twelve subsequent authors before outlining the scheme actually adopted; one making no radical breaks with the past. The bulk of the work consists of detailed descriptions of 112 European species, using a fairly broad species concept (the influence of the Dutch school is acknowledged). Each receives a fine colour photo, a full page of drawings of microcharacters, extensive synonymy + misidentifications, approved Icones (sometimes a dozen or more), the type diagnosis (in Latin and Italian), a full description, details of material studied (up to 30+ collections), a paragraph of observations and a 'historicallnomenclatural note'. This last can be very extensive, sometimes including type descriptions of further species on which no judgement is offered. There are however no maps or other distribution data.

Comparison should be made with the 1998 *Lactarius* volume by Heilmann- Clausen *et al*. in the Fungi of Northern Europe series (reviewed in *Mycotaxon* **72**: 525. 1999). Basso accepts all but two of their 97 species (*L. roseozonatus* is treated only as a variety of *L. trivialis,* and *L. syringinus* is left in limbo pending further investigation). But she also has a *L. mitissimus,* distinct from *L. aurantiacus* and rescues *L. britannicus* from synonymy with *L. fulvissimus* - placing it in a different subgenus, which seems unsatisfactory. Most of her remaining further species come from outside Northern Europe, three occurring with *Alnus viridis* in the Alps and eight with *Cistus,* etc., in the Mediterranean region.

The one real disappointment is the hierarchy of keys exactly reflecting the systematics. These are more in the nature of a formal arrangement than keys for practical use; the all-important key to subgenera is a major stumbling block. So this is by no means the ideal identification guide.

It is also much too heavy! But it remains a formidable achievement and an indispensable source-book for the *Lactarius* specialist.

ALICK HENRICI, 8 Victoria Cottages, Richmond, Surrey TY9 3NW, UK

***Armillaria* Root Rot: Biology and Control of Honey Fungus.** Edited by Roland T. V. Fox. February 2000. Intercept, P. O. Box 716, Andover, Hants SP10 1YG, UK. Pp. xxiv + 222, 10 coloured plates. ISBN 1 898298 64 5. Price £ 47.50 (US $ 88) (including postage and packing).

This thoughtfully put together and welcome book on this important group of pathogens has 10 contributors who between them provide authoritative overviews of the current state of knowledge of most aspects of these fungi: Biology and Life Cycle, Ecology and Epidemiology, Quantitative Aspects, Molecular Methods, pathogenicity, The Extent of Losses, Cultural Methods, Chemical Control, Biological and Integrated Control, and Answering All the Questions. This book is mentioned here because of the chapter on Taxonomy, Nomenclature and Description of *Armillaria* by David Pegler (pp. 81-94); this includes a very full generic description, a synopsis of the 42 accepted world species (with full citations and synonyms), a key to the 8 species known in Europe, and a comprehensive description of *A. mellea* itself. Faced with Pegler's treatment, mycologists and plant pathologists who have been avoiding getting to grips with the taxonomy of the pathogenic species of *Armillaria* no longer have any excuse.

Les Gastéromycetes de Corse: Taxonomie, Écologie, Chorologie. By B. Moyersoen and V. Demoulin. December 1996. [Lejeunea, Nouvelle Série No. 152.] Société Botanique de Liège, Sart Tilman, B-4000 Liége, Belgium. Pp. 128, 58 figs, 61 maps, 80 half-tones. ISSN 0457-4184. Price Bf 500 (+ postage and packing Bf 60).

Although dealing with a single island, Corsica, this work will have a wide appeal amongst mycologists working in the Mediterranean region as it deals with 63 species, and is accompanied by line drawings of microscopic features and numerous half tones, mainly scanning electron micrographs of basidiospores. These are very welcome as there is a tendency not to illustrate such critical details in macromycete identification guides. Not all species are provided with full descriptions, but full details of collections examined and extensive literature references are included. I was, however, surprised not to see a key nor an index; the latter would have been useful as the fungi are arranged by orders and families. Seventeen species are first reports from the island, and one new species is described, *Rhizopogon corsicus* – the only species to have a habit photograph included. There is a welcome emphasis on ecology and distribution and a synoptic table of the species to be found on different soil types. The sand dunes were a rich source of species, and the study is of interest for the species not found (e.g. *Phallus hadrianii*) as well as those discovered. If you are foraying in the Mediterranean region, this would be a useful adjunct to the set of identification manuals to pack.

IMPORTANT NOTICE TO AUTHORS ON ABSTRACTS AND KEYWORDS

ABSTRACTS, beginning with volume 76, are required for all articles exceeding four printed pages in length. The abstract should be brief but informative, should include all newly proposed names, and should be no ore than 15 printed lines long. Do not include authorities for taxa (unless hey are necessary to distinguish homonyms), as names of the authorities should appear only once, in the text where the names are first mentioned or are proposed. A second abstract in another language is still permitted. Beginning with volume 76 manuscripts that do not meet these criteria will be returned to authors for correction.

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ERRATA

VOLUME SEVENTY-ONE

Page 378, line 17	for *eremophilium*	read *eremophilum*

VOLUME SEVENTY-TWO

Page 430, line 1	for *Ahernaria*	read *Alternaria*
Page 430, line 2	for *compacta*	read *compactum*
Page 474, line 30	for *violea*	read *violacea*

VOLUME SEVENTY-THREE

Page 235, line 13	for *leucomallus*	read *leucomallellus*

Page 519 [index of taxa] many entries after Naeviella paradoxa were inadvertently omitted; insert the following between "Naeviella paradoxa 37" and "[Panaeolus] semiovatis 190"

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Page 1, line 15	for	*subpurpureophyllus Smith*	read	*Smith var. subpurpureophyllus*
Page 5, line 28	for	*piuleus*	read	*pileus*
Page 14, line 37	for	*onderosa*	read	*ponderosa*
Page 25, line 11	for	*originl*	read	*original*
Page 35, line 27	for	*reminds somewhat*	read	*reminds one somewhat*
Page 40, lines 4, 5, and page 42, line 29	for	*imperforated*	read	*imperforate*
Page 49, line 3	for	*Agaricus epicus*	read	*Agaricus epius*
Page 56, line 25	for	*dúne*	read	*d'une*
Page 122, line 23	for	*incisa*	read	*incisus*
Page 122, line 38	for	*the they*	read	*they*
Page 155, line 14	for	*phyllum*	read	*phylum*
Page 162, line 20	for	*all, Sorosporium*	read	*Sorosporium*
Page 162, line 23	for	*represent*	read	*all represent*
Page 208, line 21	for	*(later homonym)*	read	*(superfluous combination)*
Page 224, line 2, and page 225, line 2	for	*Characterstate*	read	*Character state*
Page 249, line 12	for	*Leifa*	read	*Leifia*

VOLUME SEVENTY-FOUR (No. 2)

Spine	for	*74(2): 257-546*	read	*74(2): 257-546 + i-iv, indices*
Page [i], line 5	for	*QUATERKY*	read	*QUATERLY*

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VOLUME SEVENTY-FIVE

Page 176, line 4	for	*pavalekii*	read	*pavelekii*
Page 381, line 4	for	*longicystidiosum*	read	*longicystidiatum*
Page 403, line 13	for	*serotinus*	read	*serotina*
Page 437, line 3	for	*griseobadia*	read	*griseobadius*

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